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TECHNOLOGY DEPARTMENT

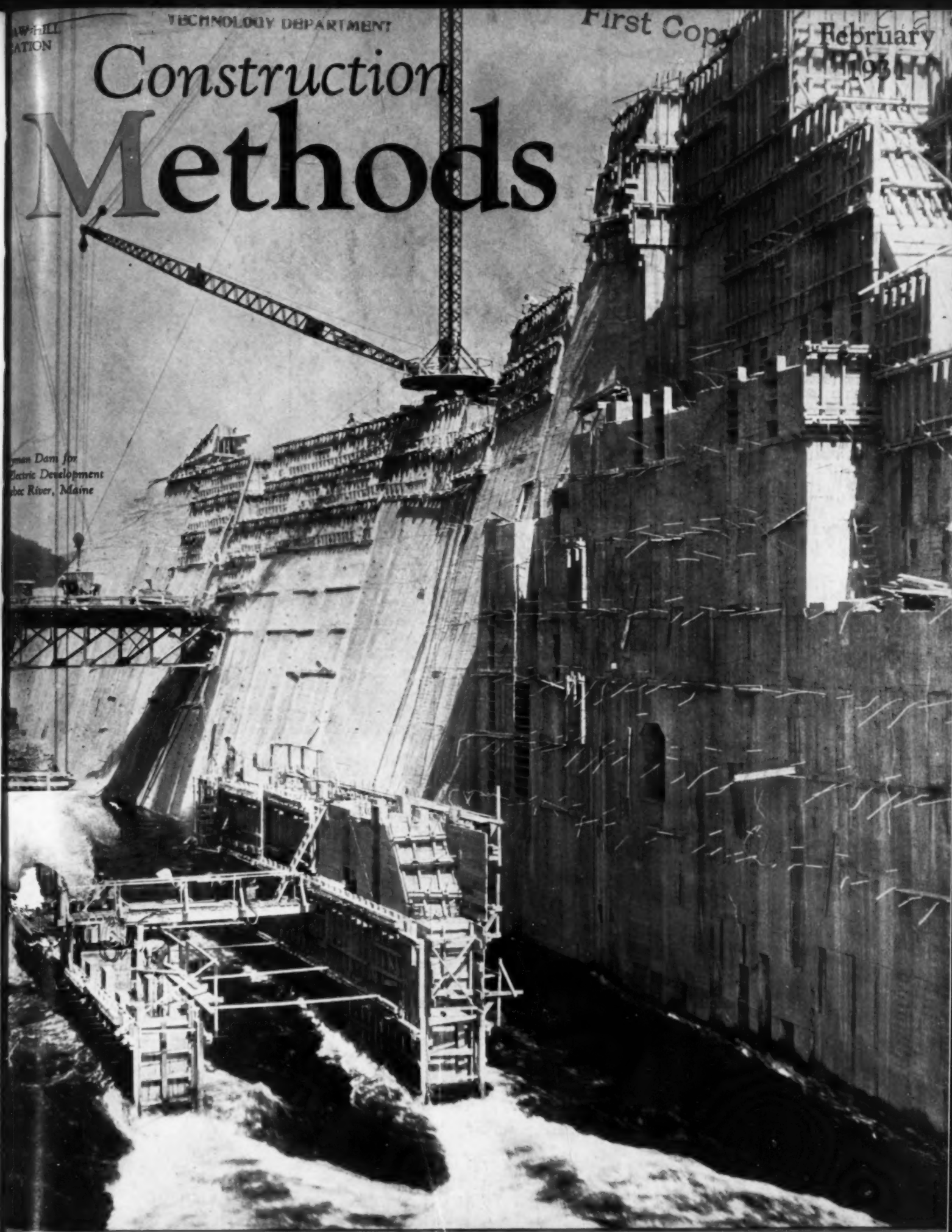
First Copy

February

1931

Construction Methods

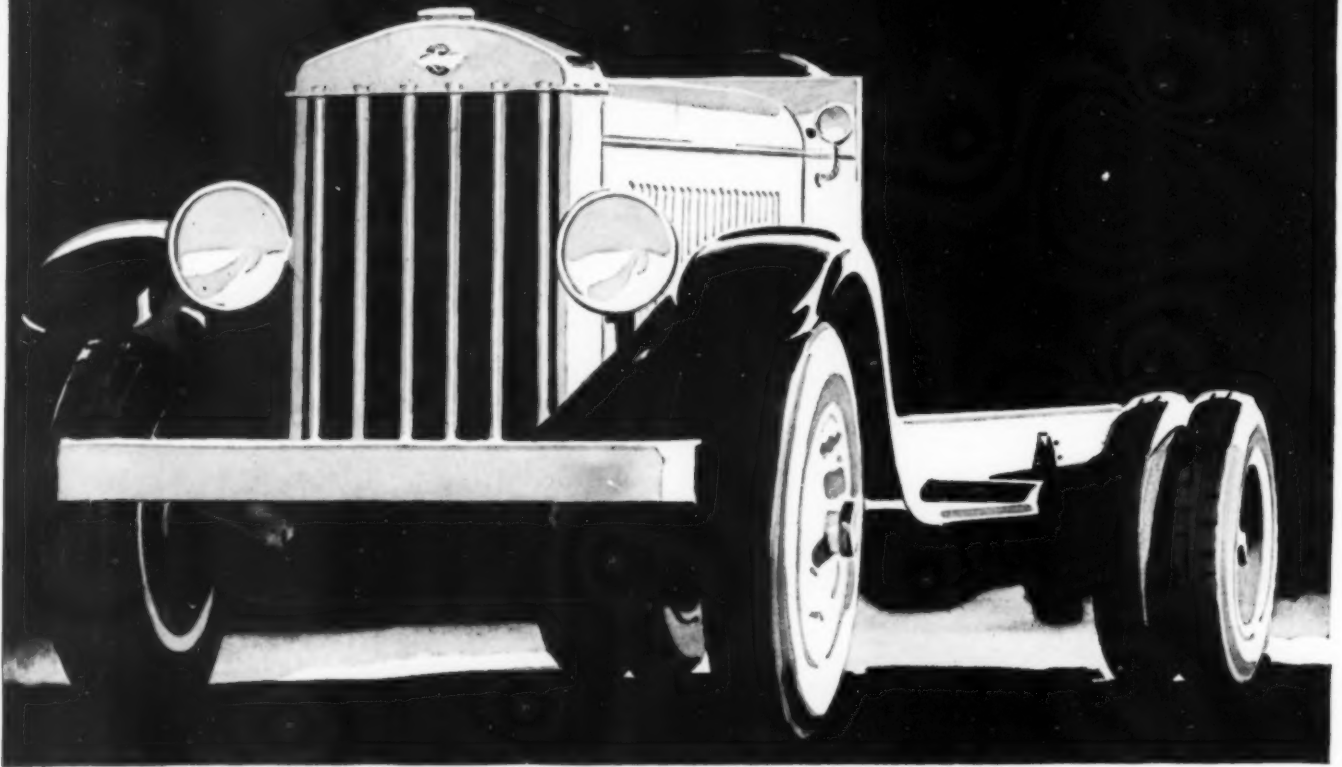
men Dam for
Electric Development
Abec River, Maine



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CONSTRUCTION METHODS, February, 1931. Vol. 13, No. 2. Published monthly, McGraw-Hill Publishing Company, Inc., Tenth Avenue at Thirty-sixth Street, New York, N. Y. \$1 per year; 10 cents per copy. Entered as second-class matter, October, 1926 issue. Vol. 8, No. 19, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

TECHNOLOGY DEPT.

February, 1931—CONSTRUCTION METHODS

The Editor Notes --



Ready for Bids on Hoover Dam

IN DESIGNATING March 4, 1931, as the date for receiving bids on the Hoover dam in the Black Canyon of the Colorado River, the U. S. Bureau of Reclamation has advanced by six months the scheduled time for starting construction on the outstanding hydraulic project of all time and by so doing opens the way for increased employment not only in the ranks of construction workers but also in the plants of manufacturers who will supply the vast quantities of equipment and materials required for the job.

With a height of 730 ft. from top to lowest point of the foundation, nearly twice as tall as any dam yet built, and a length of 1,180 ft. along the crest, the huge gravity arch structure, with its appurtenant works, involves features of design and construction without precedent in the history of projects of this type. The Bureau's plans and specifications picture an undertaking impressive not merely in size but in the boldness and originality of its design and construction features.

The work is to be awarded as a single contract instead of being subdivided into a number of relatively smaller parts. The major items of the project include the 730-ft. dam, calling for the placing of 3,407,000 cu.yd. of concrete, four 4,000-ft. concrete-lined diversion tunnels 50 ft. in diameter (later to serve as spillway and penstock conduits), power house, four inlet and outlet works, two overflow spillways and an inclined freight elevator for transferring materials down the steep side of the gorge to the damsite.

The magnitude of the job is best indicated by a few of the estimated contract quantities: Tunnel and shaft excavation, 1,912,000 cu.yd.; foundation excavation for dam and power house, 1,292,000 cu.yd.; other excavation, 2,295,000 cu.yd.; fill for cofferdams, 1,232,000 cu.yd.; concrete in dam, 3,407,000 cu.yd.; concrete for tunnel lining, 367,000 cu.yd.; reinforcing steel, 35,000,000 lb.; structural steel, 20,793,000 lb.; grout and drain holes, 378,000 lin.ft.

Among the chief contract provisions

are these: Preference in employment is to be given first to ex-service men and second to citizens of the United States. A bidding bond of \$2,000,000 and a performance bond of \$5,000,000 are specified. The time allowed for completing the contract is seven years (2,565 calendar days), with liquidated damages of \$3,000 per day for failure to complete on time. With the exception of sand and gravel the principal materials entering into the permanent construction are to be supplied by the Government.

An important provision of the contract is the assumption by the Government of responsibility for all flood damage to the work under construction after approval and acceptance of the contractor's rockfill cofferdams at the upstream and downstream ends of the damsite. Contractor's plant and equipment, however, is not included in this assumption of responsibility for flood damage.

The specifications bring out some interesting features with regard to the methods of building the dam. To provide for expansion and contraction concrete is to be deposited in columnar blocks 50x50 ft. in plan, with joints subsequently grouted under pressure through piping installed for that purpose. Dry concrete mixes (slump not to exceed 3 in.) are to be used and placing by means of bottom-dump buckets is required. Absolutely unique is the provision of a system of piping, carrying refrigerated water, to draw off the heat generated by the chemical action of the setting cement. This cooling system alone calls for the installation of 800,000 lin.ft. of 2-in. piping.

For the main body of the dam and for concrete linings of tunnels and shafts where forms are used more than once, metal or metal-faced forms are required.

The entire upstream face of the dam is to receive a 1-in. coating of gunite.

The stage is set for one of the greatest and most dramatic construction performances ever undertaken. The leading engineering rôles have been cast from the personnel of the Bureau of Reclamation and its consultants. The selection of principals, to play the construction parts awaits the canvass of bids at Denver, March 4.

CONSTRUCTION METHODS

A monthly review of modern construction practice and equipment

ROBERT K. TOMLIN, Editor

Editorial Staff

VINCENT B. SMITH

NELLE FITZGERALD

J. I. BALLARD (San Francisco)

WILLARD CHEVALIER, Publishing Director

A McGraw-Hill Publication
Tenth Avenue at 36th Street, New York

"No Rest Ahead for the Conservatives—"

FOR any person of vision the address on "The Future of Man," presented recently by Prof. William F. Ogburn, of the University of Chicago, before the American Society of Naturalists, makes fascinating reading. Prediction in sociology, it is explained, may be made either by the simple extension of a trend line or by the projection of the factors that determine the particular trend under consideration. Guided by these principles Prof. Ogburn sets forth upon his journey of exploration into the Land of Tomorrow.

Of immediate interest to both the maker and the user of construction equipment is the log of the adventurer's trip into the region of inventions and scientific discoveries. For the future Prof. Ogburn sees their number increasing. Through the centuries they are accumulative and, as the pile accumulates, more and more inventions are made, since they do not appear to be restricted seriously by the limitation of human wants.

"So," concludes the eminent sociologist, "in the future environment of man one sees an increasing number of inventions and discoveries occurring with greater rapidity. This, of course, means change. There seems to be no rest ahead for the conservatives."

Applied to the construction field this prediction means a constantly growing development of improved equipment, of new materials and of the application of both to new uses. It means an ever-increasing usefulness for a publication like *Construction Methods* whose primary purpose is to carry to its readers among engineers and contractors the news of progress in the methods and the machinery available for carrying on their work. It means for the alert manufacturer endless opportunities to translate these scientific discoveries and inventions of the future into new working tools and, through the medium of the advertising page, to deliver quickly, effectively and economically the message of their enlarged service. Each new invention means a new problem of *adaptation*—the creation of a new market or the education of present buyers in the uses of the new product.

Within the space of a comparatively few years any one who has witnessed the transition of construction from a succession of hand-labor operations into an industry now highly mechanized will agree with Prof. Ogburn when he says, "There seems to be no rest ahead for the conservatives."

Willard Chevalier
Publishing Director

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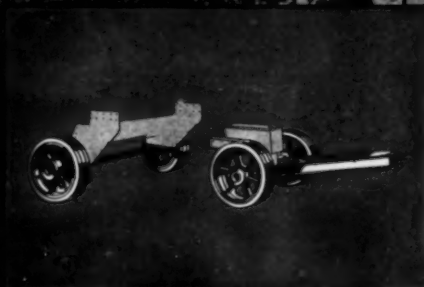
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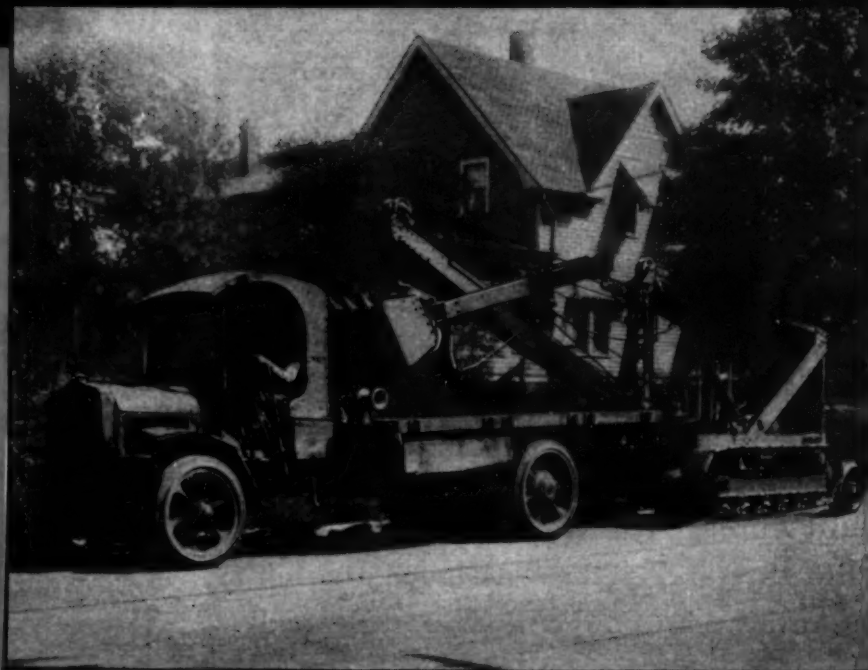
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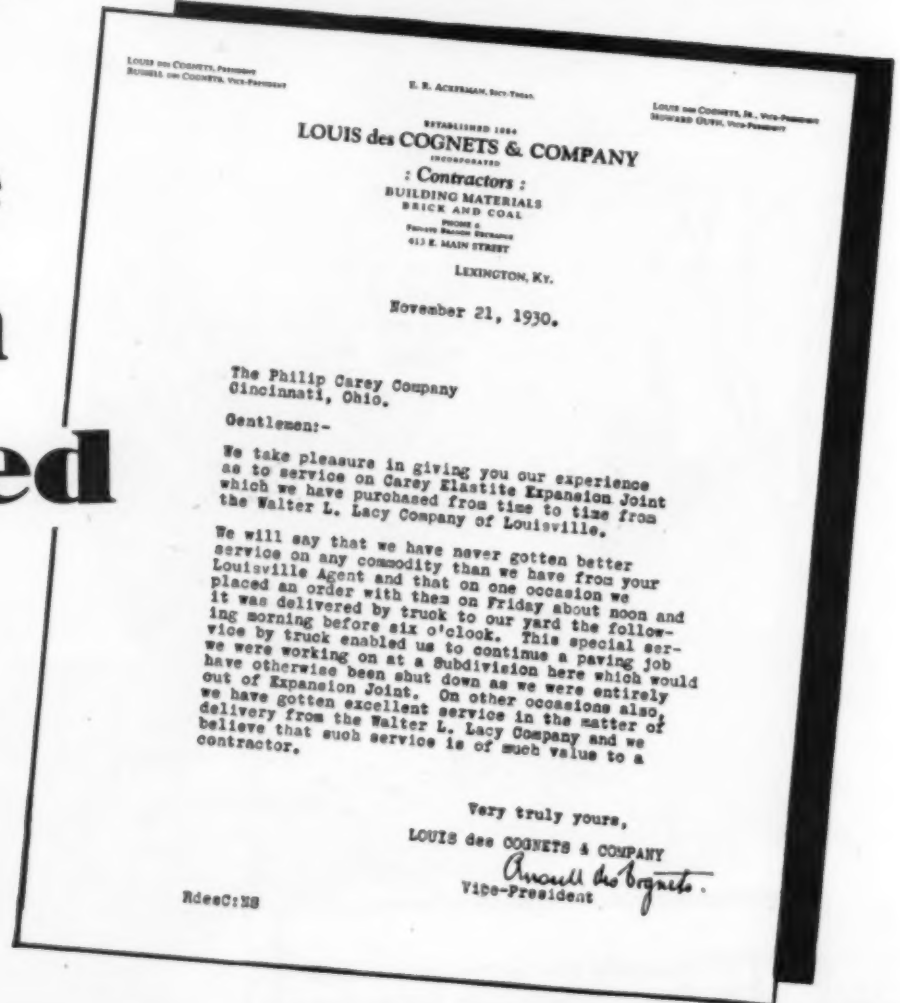
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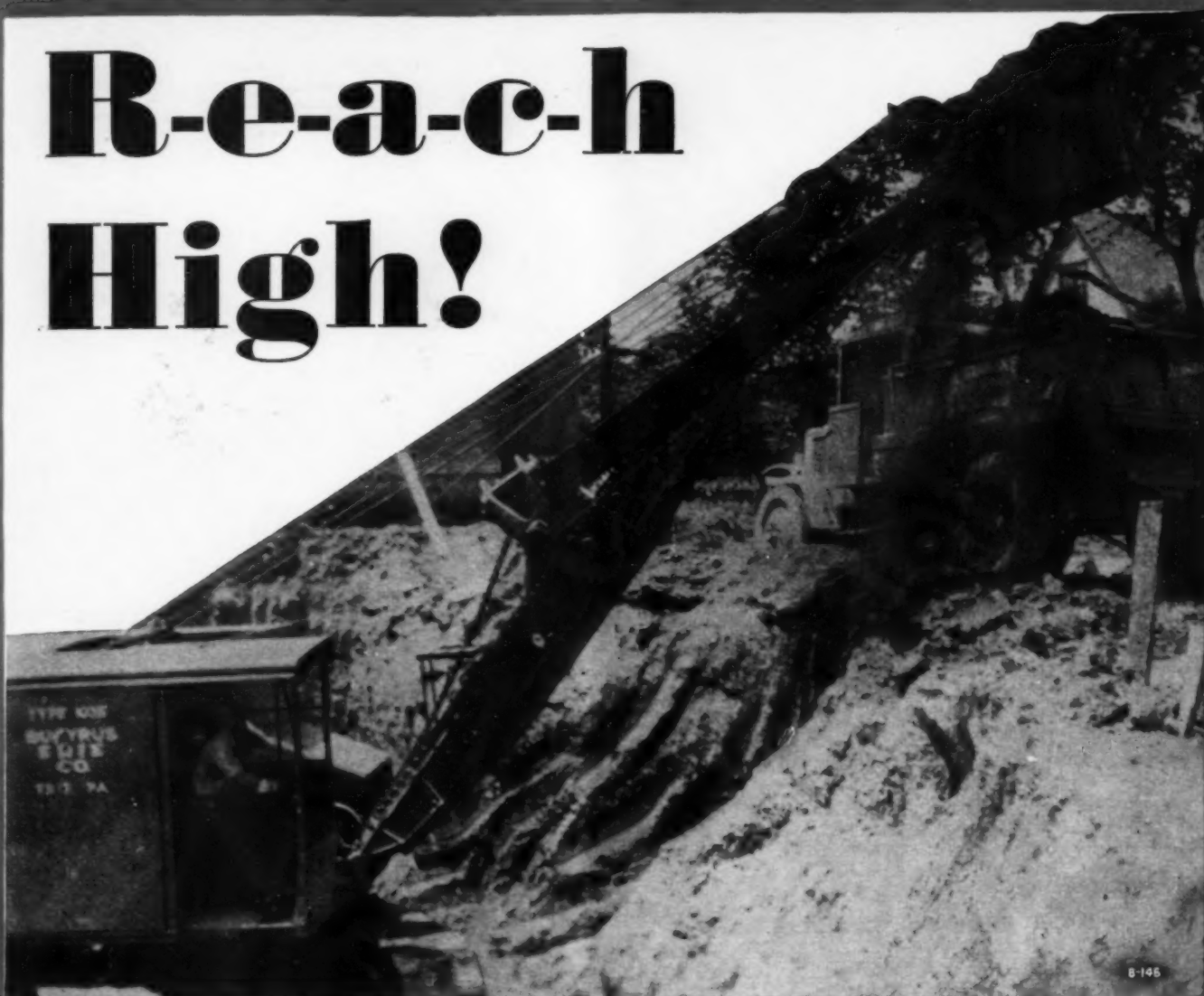


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2
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4
4-1/2
5 and
up to
16
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shovels

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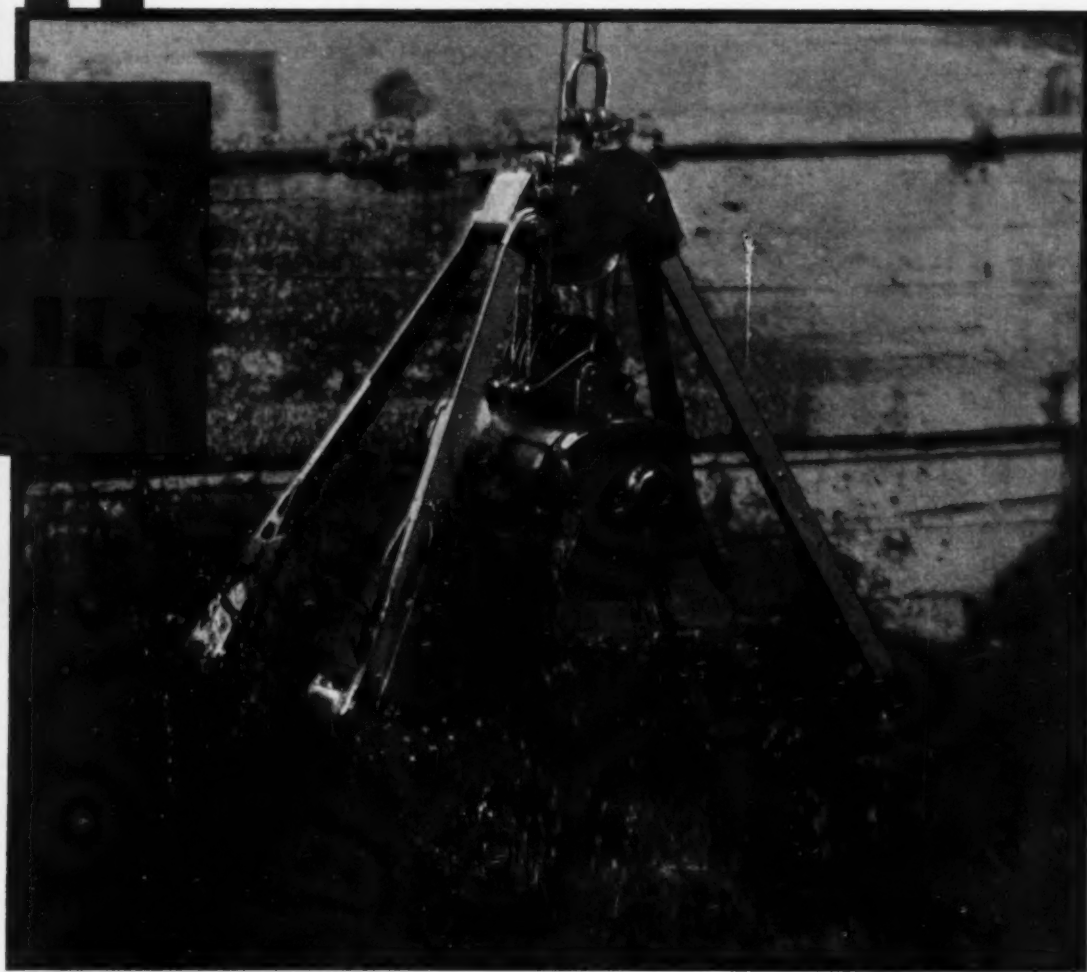
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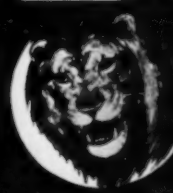
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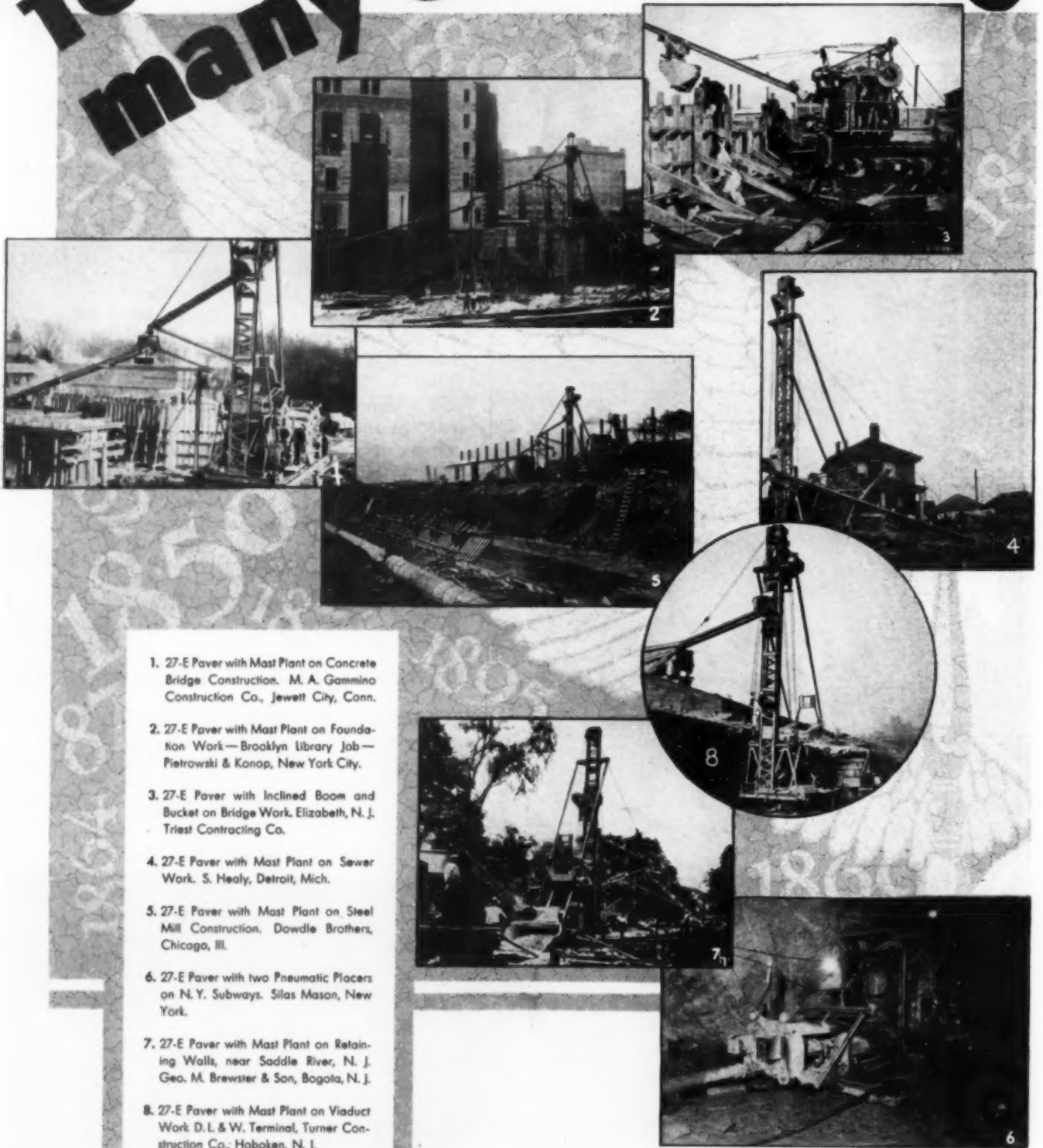
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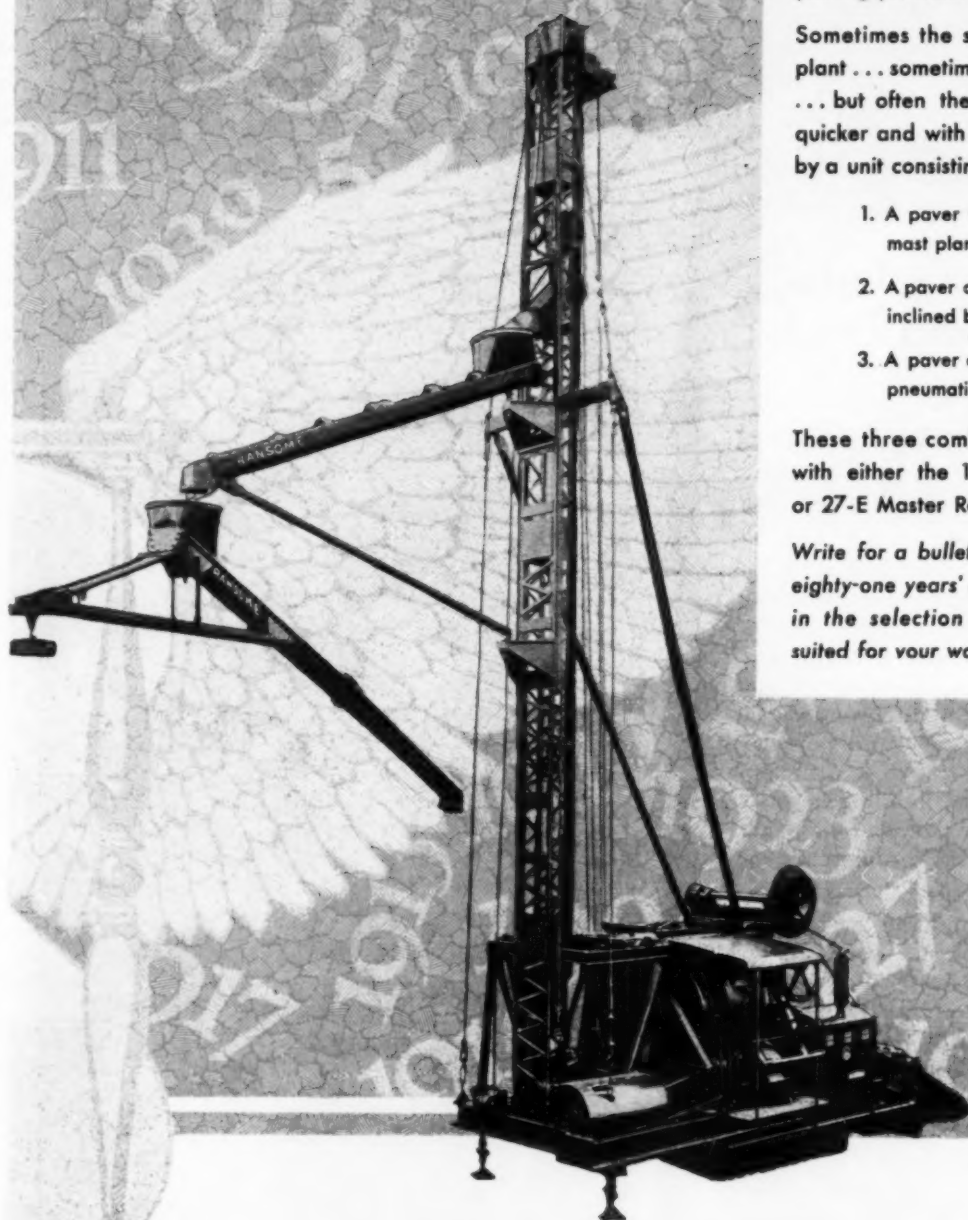
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3. A paver combined with a pneumatic placer.

These three combinations are made with either the 13-E Ransome Paver or 27-E Master Ransome Paver.

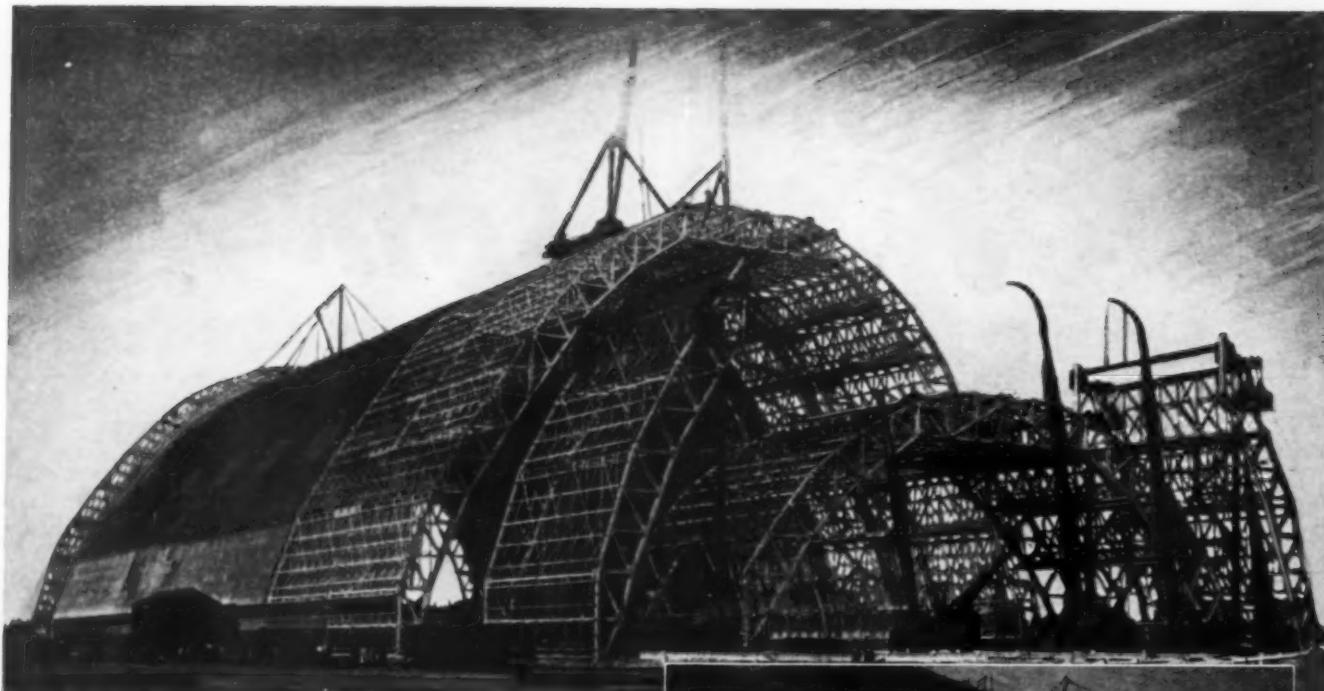
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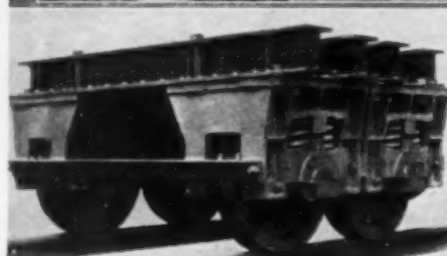
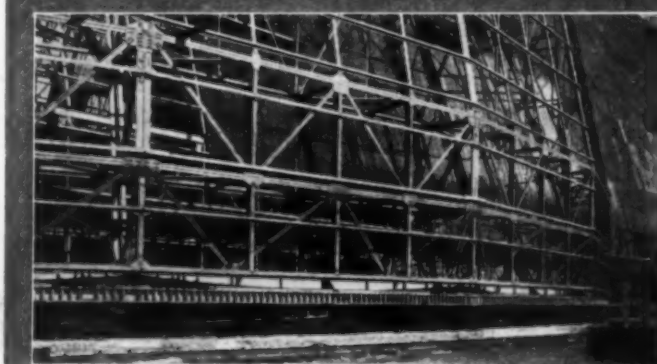
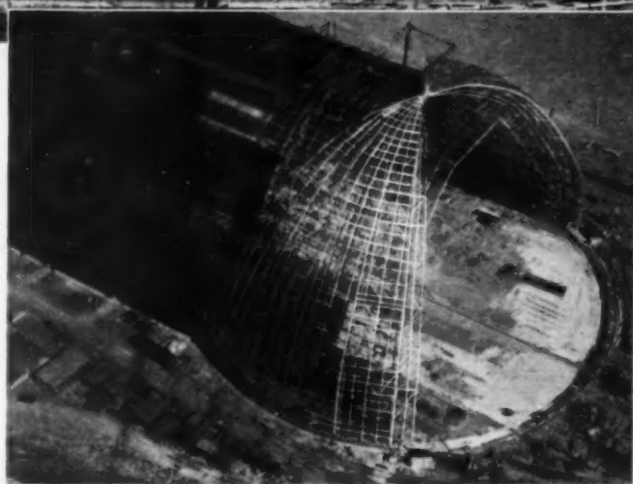
Building the World's Largest Airship Factory and Dock

LENGTH, 1175 feet; width, 325 feet; height, 197½ feet; floor area, 364,000 square feet—a building that could hold six miles of standard freight cars—that is the Goodyear-Zeppelin Airship Factory and Dock at Akron, Ohio.

A unique method of erecting the structural steel for this enormous building was employed by the American Bridge Company. The lower sections of a pair of arches were erected to about 100 feet in height and 80 feet apart, on temporary bents. Then the center portion of the arches, assembled on the ground on a cradle, was lifted into place by means of counter weights carried on the side sections and the drums of locomotive cranes. The shell of the building consists of eleven full arches and two sets of end diagonal arches. The main truss members throughout are C B's (Carnegie Beams).

The most unusual feature of the building is the large "orange peel" doors. Each leaf of the doors weighs 600 tons. Obviously the simplest way to move this heavy leaf was on wheels running on a track. Trucks designed by the Wellman Engineering Company were mounted on 27" Carnegie double flange Crane Wheels. Carnegie Beams, connected to the top of the trucks, bear the weight of the door. There are ten of these trucks to each door.

A conspicuous feature in recent, outstanding construction is the use of Carnegie Beams. Our engineers are at your service.



CARNEGIE STEEL COMPANY : PITTSBURGH

Subsidiary of United States Steel Corporation



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See it demonstrate *and you'll understand why*

HUNDREDS of new Monarch "35" Track-Type tractors will reduce dirt moving and road maintenance costs in 1931—Monarchs that *needed only a demonstration* to show contractors and public officials alike how much a tractor can have "on the ball".

See the "35" demonstrate! Your Allis-Chalmers dealer will gladly put one through its paces. Watch it pull heaping wagons through tough places! See its power and traction behind a bulldozer! Notice how easily it pulls that grader with blade set deep! You'll realize that weight for weight, here is something

never before achieved in tractor performance.

No accident, this performance. Monarchs are the product of men who were learning to build tractors when Roosevelt was president—and of a company which is known the world over for its leadership in power machinery.

Let a Monarch "35", "50" or "75" demonstrate, and you'll own one.

**A
free
trial**
on your job
Ask your Dealer

*For example, in its first year (1930) more "35's" were purchased for Iowa road work than any other tractor in its class.

**ALLIS-CHALMERS
MANUFACTURING COMPANY**
Industrial Tractors Division — Springfield, Illinois
MONARCH "75", "50" AND "35" TRACK-TYPE TRACTORS, INDUSTRIAL TRACTORS



Overall Length .	11'-9"	12'-6"	9'-6"
Overall Width .	6'-10"	5'-9"	5'-0"
Overall Height .	6'-1"	6'-1"	4'-10"
Radiator Front area, sq. in. . .	1030	865	396

"FOUR AIR *went to school*". .

Here's the air-cooled "Davey," showing heavily finned construction, aluminum alloy compressor heads and manifold. Needless piping, water and heavy heat-resisting water jackets are eliminated which account for this unit being proved equally efficient as water-cooled units but without their excessive weight and bulk. With this compactness and light weight, the Davey operates successfully on a wider variety of mountings than any water-cooled compressor can.

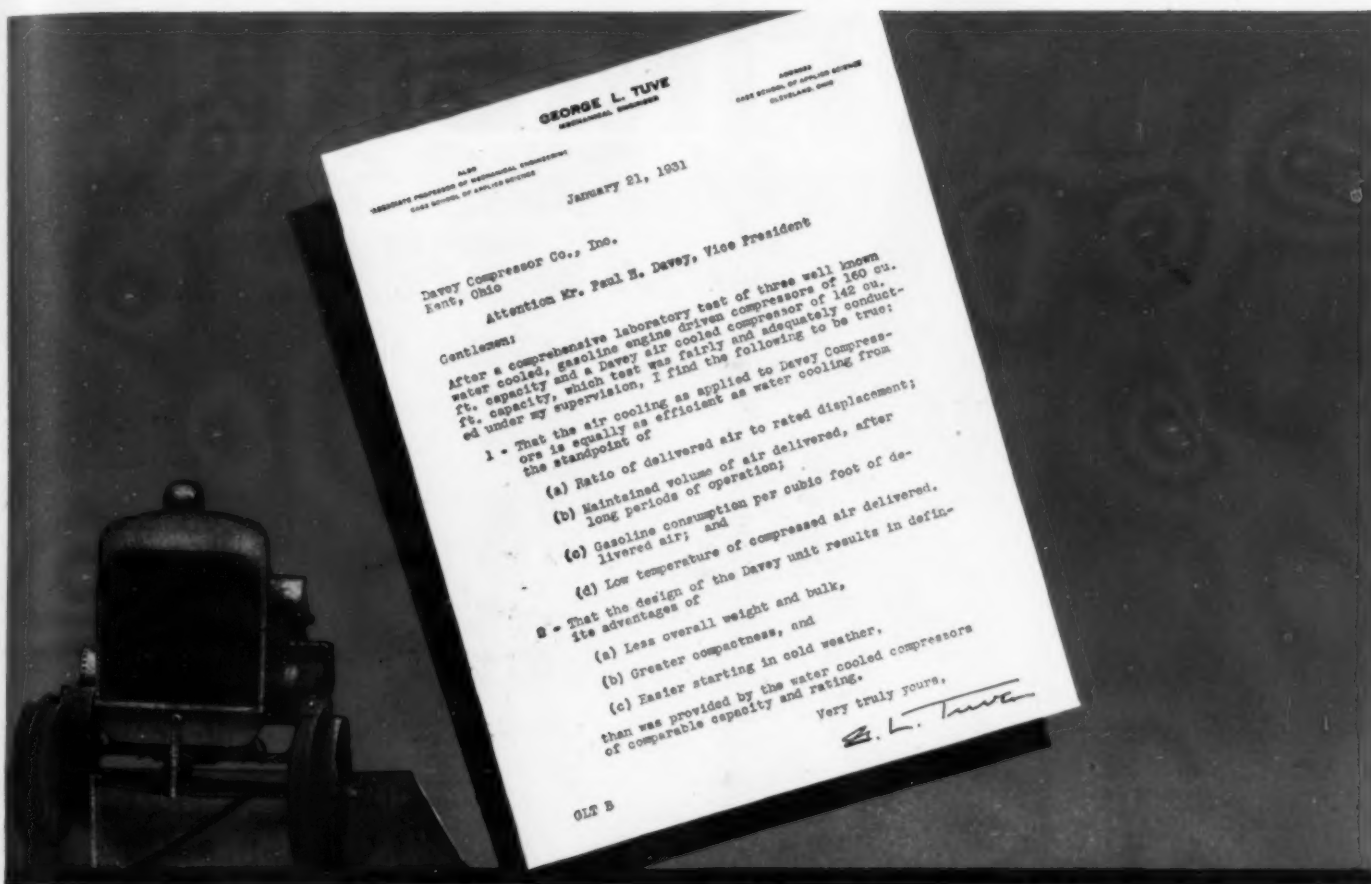
The method of cooling air compressors through the use of metals of high heat conducting quality and capacity, as contained in Davey Compressors, is fully protected by patent.

HOW would *you* like to "go to school" for an examination five hundred hours long? That's what a portable Davey Air-Cooled Compressor and three leading makes of 160 cu. ft. water-cooled compressors did.

They were submitted to laboratory tests that were probably the toughest, the longest, and scientifically the fairest, ever given this type of equipment by unprejudiced mechanical engineers.

The Davey Air-Cooled Unit was the "honor student."

Why this test? So *you* could know the plain facts about the four leading portable air compressors on the market today. You *should* know, if you operate them on your job. You should know why air-cooled compressors, as designed by Davey Engineers,



12'-8"

6'-11"

6'-0"

825

New Booklet "4 Air Compressors Went to School" tells the whole story. Write for your copy today.

COMPRESSORS

are rapidly being accepted by contractors as the biggest forward step in the field of portable air compressor design. The booklet, "4 Air Compressors Went to School" tells you why! Write for it.

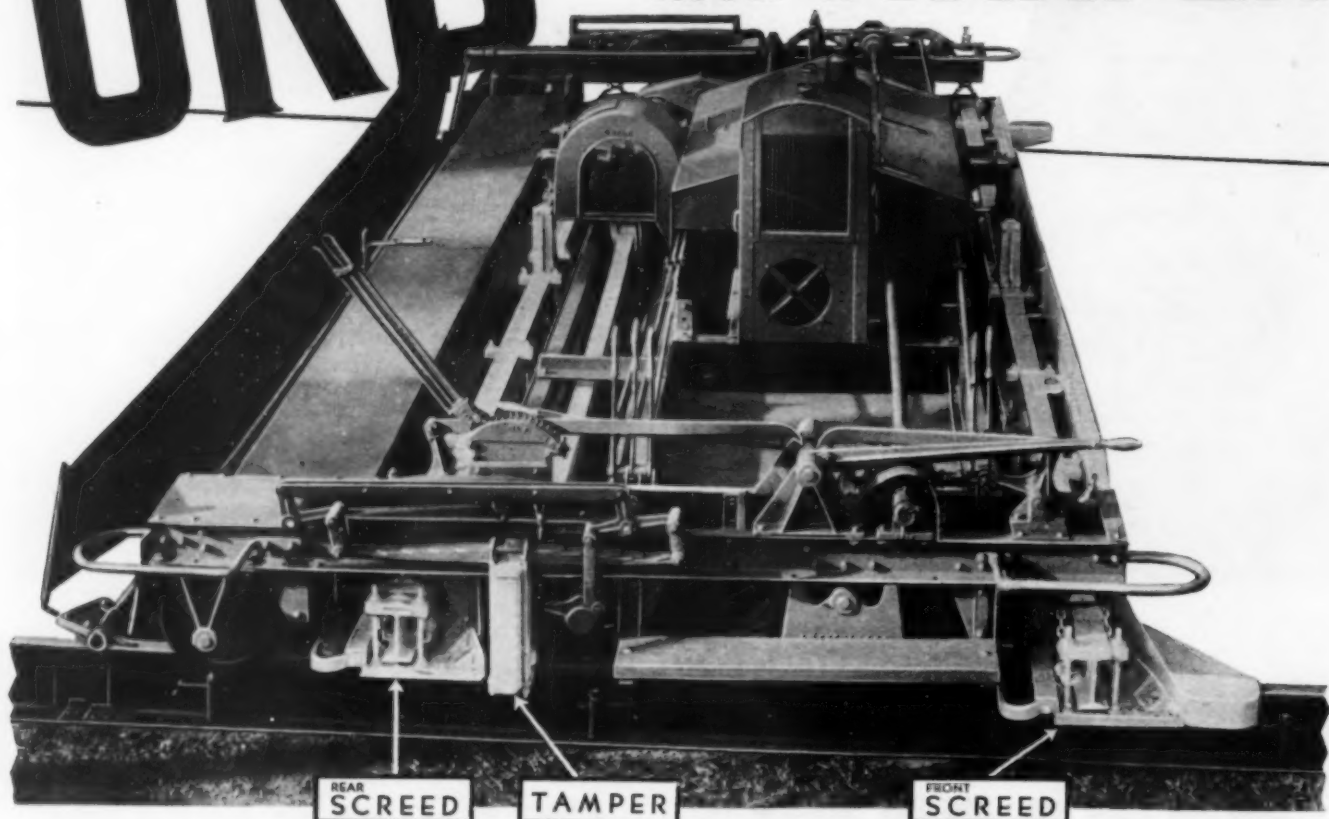
A copy is waiting for your request. No obligations; Davey is glad to put the startling facts before you in this illustrated booklet.

DAVEY COMPRESSOR COMPANY, Inc., Kent, Ohio
SALES REPRESENTATIVES IN ALL PRINCIPAL CITIES



ORD FINISHER

with TWO Screeds and a TAMPER



The ORD can be furnished
 — with single screed
 — with double screed
 — with single screed and tamper
 — with double screed and tamper

A new ORD development—TWO SCREEDS and a TAMPER in one finishing machine.

When dry, stiff concrete is used, and tamping is permitted or specified, the ORD can be furnished with a tamper without sacrificing the accepted double screed principle.

The ORD easily takes care of the paver's maximum production under the most difficult working conditions.

The 1931 ORD FINISHER retains all its advantageous features of smooth finishing, easy operation, quick adjustment, long service with minimum repairs.

Remember—the ORD has two screeds and a tamper if needed.

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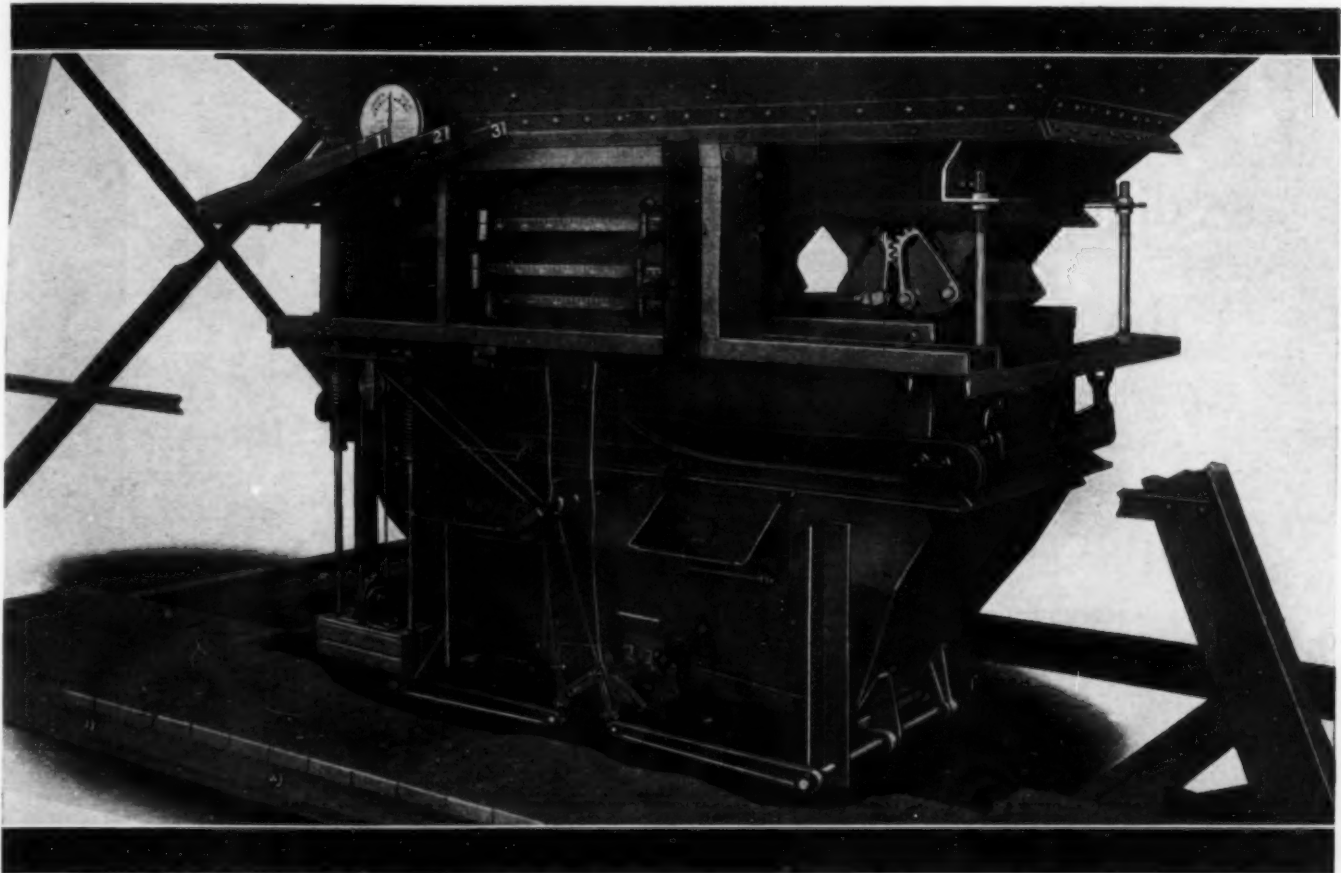
Learn more about the dependable ORD

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BLAW-KNOX

Road Forms—Ord Road Finishers—Batcher Plants—Weighing Batchers—Volume Batchers—The Cement Tank—Bulk Cement Plants—Wagon Graders—Steel Forms for Streets and Sidewalks
 Truck Turntables—Nu-Method Finish Grader—The Inundation System—Clamshell and Dragline Buckets—Ready Mixed Concrete Plants—Truck Bodies.

Contractors who need dependable and accurate **WEIGHING BATCHERS**, deal with Blaw-Knox . . . *it pays.*



In Blaw-Knox Weighing Batchers you'll find the best scale equipment that money can buy . . . bunched controls for the operator's convenience . . . provision for quick leveling . . . with absolute volume control . . . and a springless "tell-tale" dial to measure every batch to the last pound.

Shipped complete, ready for instant service. Arranged, as desired, to weigh one, two, three, four or more different types of aggregates quickly and accurately.

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Truck Turntables—No Method Finish Grader—The Inundation System—Clamshell and Dragline Buckets—Ready Mixed Concrete Plants—Truck Bodies

ROCK, the toughest kind of digging for any shovel, simply proves the soundness of Thew's basic design . . . the center drive . . . the greatest specification a shovel can have.

THE THEW SHOVEL COMPANY
LORAIN, OHIO



T H E W



It's **ROCK** *that* *tests a* **SHOVEL**

In Utah a single blast breaks up the side of a mountain—250,000 tons. And the shovel selected to dig and load it is a Thew Lorain.

In a New England quarry Thew Lorains have replaced heavier, bulkier machines because they have the staying qualities that rock handling demands, plus lowered operating costs.

In West Virginia, notorious for its tough digging, more than half the shovels purchased for construction projects are Thew Lorains.

Where there is rock excavation to be done, there can be no fooling about the staying qualities of the machine.

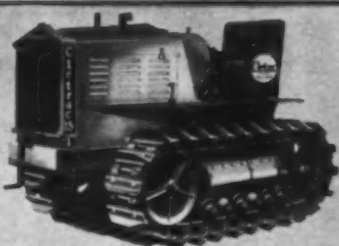
LORAIN

45
55
75

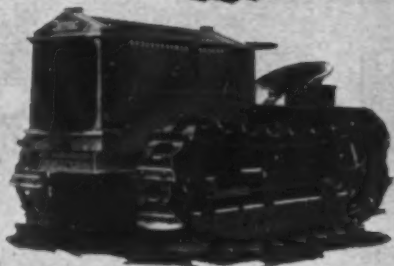
MAKE YOUR EQUIPMENT

Hook it up with

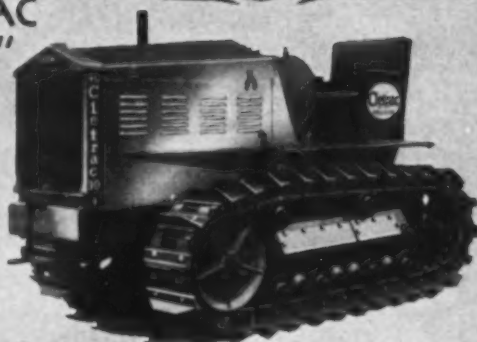
CLETRAC
"15"



CLETRAC
"20"



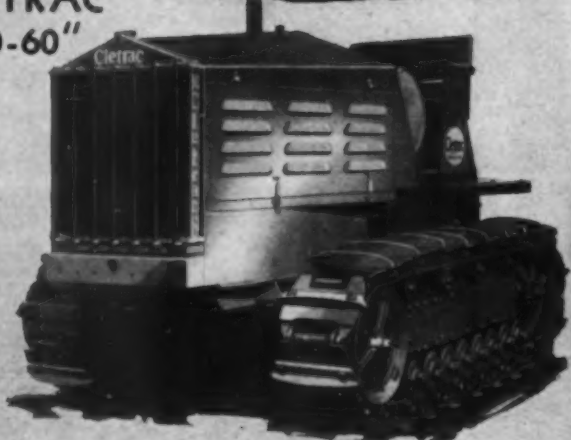
CLETRAC
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CLETRAC
"40"



CLETRAC
"80-60"



NEVER BEFORE, IN A SINGLE TRACTOR LINE, HAS THERE BEEN OFFERED SO COMPLETE AN ARRAY OF INDUSTRIAL POWER UNITS AS YOU FIND IN THE 1931 CLETRAC SERIES. WITH A RANGE FROM 15 H. P. IN THE SMALL CLETRAC, UP TO A MAXIMUM DELIVERY OF 80 H. P. IN THE BIG "EIGHTY-SIXTY", THE LINE MEETS FULLY EVERY POWER NEED IN THE HANDLING OF OUTDOOR INDUSTRIAL WORK. • • •



EARN BIGGER MONEY CLETRAC POWER

THE value of your tractor operated equipment, like everything else in your business, is measured by its ability to *earn money*. And that earning ability is made big or little by the efficiency or inefficiency of the tractors you use.

Cletrac Crawlers offer the kind of sure-footed, abundant power that boosts the performance of any piece of equipment and gets from it the very limit of its capacity.

Cletrac Crawlers are known the world over for their unmatched delivery of power at the draw-bar and their ability to turn out a bigger day's work every

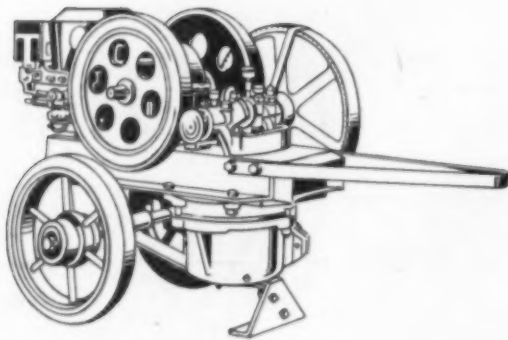
day in the year. Rolling along on sure-gripping, broad, steel tracks they make equipment get down to business regardless of the odds of weather or bad going. They handle easily and travel fast, saving time and costs on every job.

Thousands of Cletracs are used by highway departments, road and general contractors and county and municipal authorities. Cletrac's ability to handle all kinds of work speedily and economically has gained for them outstanding recognition and preference.

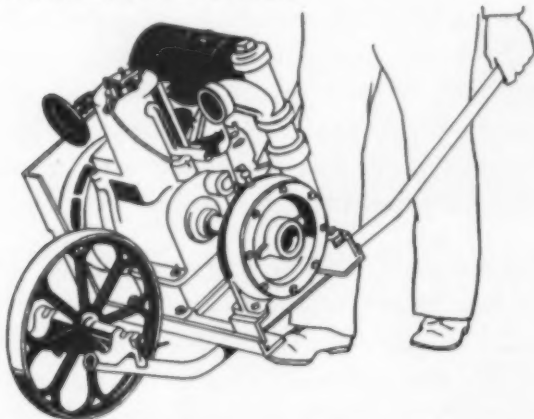
See the Cletrac distributor or write for complete details on any or all models.

The Cleveland Tractor Co.
19323 Euclid Ave., Cleveland, Ohio

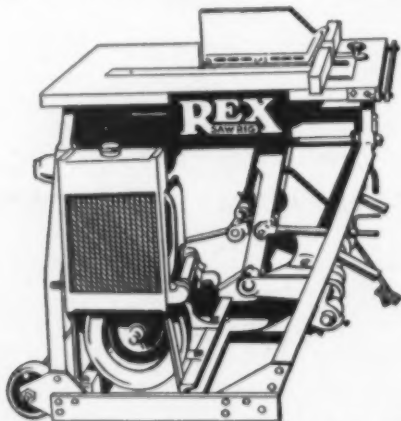




REX 3" DIAPHRAGM—Another super value on a new idea—Weights but 525 lbs., that's 250 below the average—Measures but 30" high, 29" wide, 42" long—But handles 6500 g.p.h. on 7' lift at sea level—The only 3" pump with famous 9-minute diaphragm change—1½ h.p. engine—Long-life diaphragm—Price with steel wheels, only \$175.00 f.o.b. Milwaukee.



REX WATER BOY—World's lightweight champion—A 2" Centrifugal with ball bearing impeller—Only 23" wide—Weights but 300 lbs.—Mounted for one-man handling anywhere—Maximum capacity 9300 g.p.h.—Will handle heads up to 50 ft.—1½ h.p. self-oiling, air-cooled engine—But price is only \$170.00 f.o.b. Milwaukee.



REX No. 3 SAW RIG—Home Builders' Special—Only 28" wide—wheel-mounted—45 degree tilting table—Improved saw guard—Handles dadoing, mitering, beveling, double-mitering, etc.—1 h.p. self-oiling engine, radiator cooled—Electric motor if desired—Blade cuts off in straight line—no arc. With gasoline engine, \$275.00 f.o.b. Milwaukee.

REX

CONSTRUCTION EQUIPMENT

REX Mixers—Pumps—Saw Rigs—Plaster and Mortar Mixers—Pavers—Complete Concrete Factories—Moto-Mixers—Moto-Agitators—Moto-Remixers—Elevators—Conveyors.

YOUR pockets, and especially the money that's in them, will be interested in this advertisement.

Rex Pumps, Mixers, Saw Rigs and other machines are designed, built and priced to give you more for fewer dollars.

Giving you more for less gives Rex greater volume. Such increased volume means lower manufacturing costs.

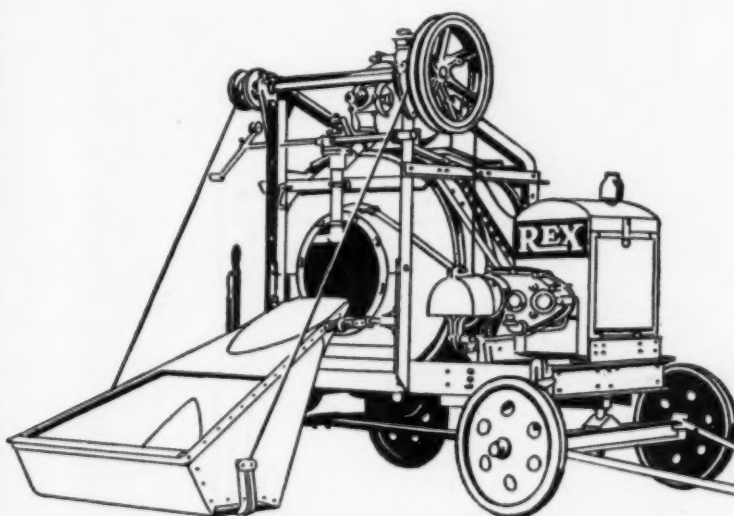


In other words, Rex actually can give you more for your money. So we don't have to sell Rex with loud, boastful statements. We let Rex Machines sell themselves by the way they're designed—the way they are built—the way they perform—the astonishing way they are priced. Make any comparisons you wish

Y Your Pockets



PLASTER-MORTAR MIXER—Home Builders' Special—Handles any stucco, plaster or mortar, with or without hair—Sealed bearings—Criss-cross mixing—better batches in less time—Adjustable, hardened scrapers—High-carbon steel paddles—6 cubic ft. capacity—Spring-mounted axle and rubber-tired wheels, only \$390.00 f.o.b. Milwaukee.



REX 7-S MIXER—Shimmy skip—All-Steel drum—Steel drum rollers—Timkens—Enclosed, in-oil, cut-gear transmission—7-second skip—7-second discharge—Only 93 inches long—Weighs 500 lbs. less—End controls—Skip knockout—Automotive clutches—But only \$895.00 with Le Roi Engine and steel wheels, f.o.b. Milwaukee.

CHAIN BELT COMPANY,
1664 West Bruce Street, Milwaukee, Wisconsin

Cable Address: Beltechain

"That Men May Build Better, Faster, Cheaper." This coupon brings a copy of this book which tells the story in cold, hard figures and facts what these Rex Machines are and do:

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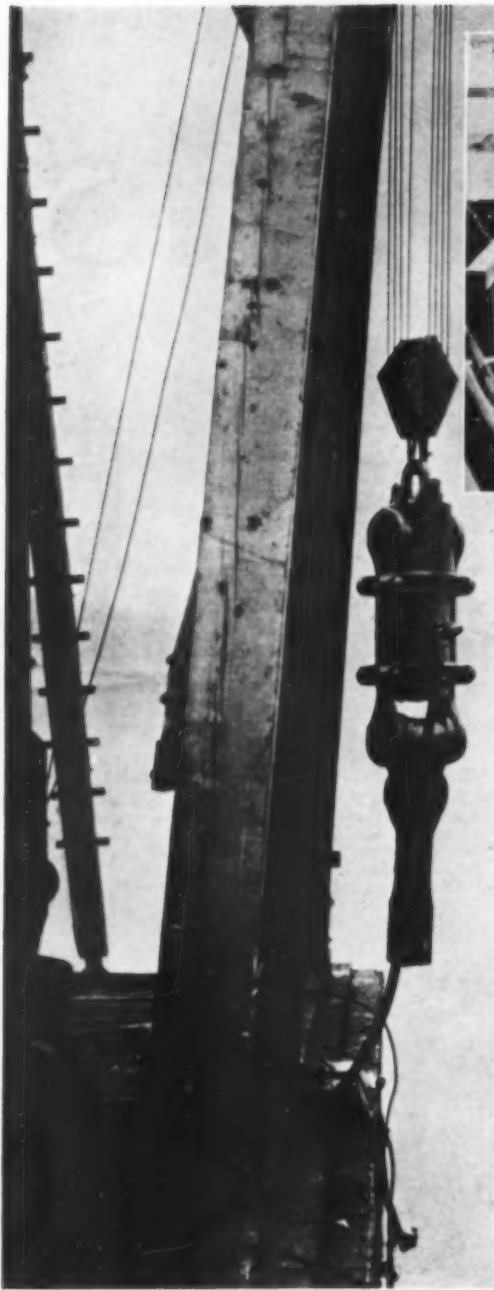
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Also Concrete Factories and Moto-Mixers, Paving Mixers

with any other machines. You be the judge. The latest Rex Book called "*That Men May Build Better, Faster, Cheaper*"—tells in facts and figures what Rex Pumps, Mixers, Saw Rigs and similar machines are and do. Ask for a copy with this coupon—in the interests of your pockets.



Warrington-Vulcan Pile Hammers have been in successful use since 1887 on important jobs the country over. They have never been equalled for economy, speed of operation, and freedom from mechanical troubles.



This is a pile Extractor... not a pile hammer!

The contractors are finding it pays to extract all of their piling, including all types of sheet piling, with the economical Vulcan Pile Extractor.

This efficient puller is less expensive than a pile hammer. It is always ready for service without adjustment or troublesome harness and *pounds out* the piles rapidly and without damage. It is the first machine of this type built in America although used in Europe for a number of years.

Already hundreds of these Vulcan Extractors have been ordered and placed in service by the contractors. They are making good under even most difficult conditions. At least one of these Extractors should be among the plant of every contractor.

The Vulcan Extractors are made by the makers of the Warrington-Vulcan Pile Hammers, the hammers with the *punch*—the scientific application of pile driving energy. *Write for descriptive catalog.*

VULCAN IRON WORKS

327 No. Irving Avenue, Chicago, Illinois

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The VULCAN EXTRACTOR

guaranteeing the **BACKBONE** of LEROI Engines

LeRoi Engineers specify the finest, toughest steel from which LeRoi crankshafts are made. Why? Because it adds strength and long life where they are most needed . . . because it enables handling the maximum loads. Plant and field work have proven it. Perfectly balanced in itself, it is supported on exceptionally large bearings accurately line reamed to insure exact alignment assuring long life to both bearings and crankshaft. So sure that it meets all requirements, LeRoi guarantees its crankshaft for the life of the engine . . . Can you afford to overlook the power that keeps men and machinery operating at top speed . . . that insures greater net earnings on your jobs? Look to the LeRoi and demand it on all your equipment.

LEROI COMPANY, *Milwaukee, Wisconsin*



LE ROI ENGINES
FOR DEPENDABLE POWER



High-early-strength concrete pavement, made with Universal Atlas methods and cement, on Third Street, Gadsden, Ala. Percy Todd, city engineer; Jones, Rust & Griffith, Gadsden, contractors.

High-Early-Strength Concrete open to heavy traffic 48 hours after placing

AT the height of the cotton shipping season, construction work was under way on a new concrete pavement leading past the storage buildings of the Etowah Warehouse Co., Gadsden, Alabama. Each day the pavement was closed to traffic meant a loss to the warehouse company of almost their entire storage revenue on 4,000 bales of cotton.

By ordinary methods of placing concrete, the new pavement would have been closed to traffic for from 14 to 21 days. Thru the use of high-early-strength concrete, made with Universal Atlas methods and cement, the long section in front of the warehouse was placed Thursday and opened to heavy traffic early Saturday morning.

Methods for securing high-early-strength concrete with standard Universal Atlas cements will be sent on request. Just use the coupon.



Name _____
Address _____
Without obligation, please send me
brochure "High-Early-Strength Con-
crete for Roads, Streets and
Bridges" C. M. 231

Universal Atlas Cement Co.

Subsidiary of United  States Steel Corporation

Concrete for Permanence

Construction Methods

A MCGRAW-HILL PUBLICATION—ESTABLISHED 1919

ROBERT K. TOMLIN, Editor

VOLUME 13

NEW YORK, FEBRUARY, 1931

NUMBER 2



CLOSE CO-ORDINATION in building concrete storm drain. Distance between trenching machine and backfiller is only 250 ft., with pipe-laying crane and concrete mixer intervening.

Storm Drain Ditch Dug by HUGE TRENCHER

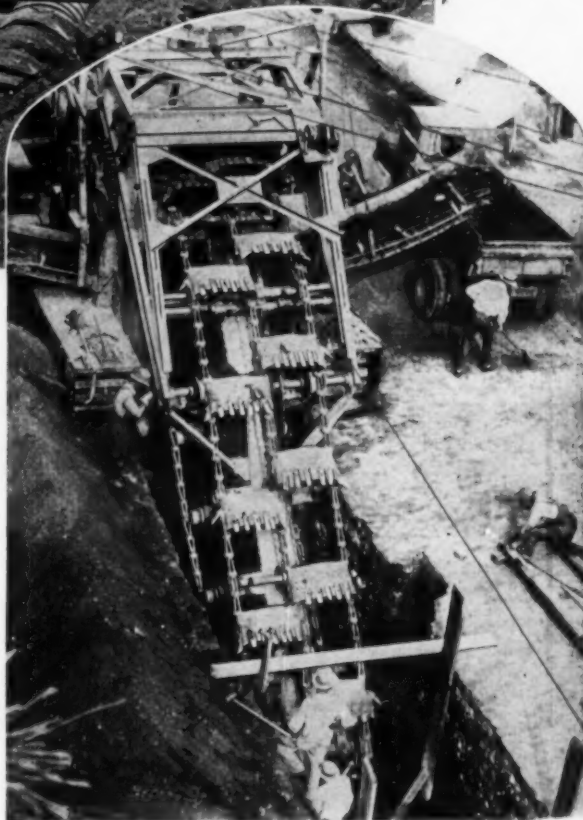
TO ACCOMMODATE precast concrete pipe from 54 to 69 in. in diameter for the Jefferson No. 3 storm drain in Los Angeles, Calif., Charles H. Johnston, contractor of that city, employed a trench excavator of exceptional size and capacity to dig a ditch averaging 80 in. wide and 9½ ft. deep. The machine, an Austin unit, was equipped with a double row of digging buckets, as illustrated, and was powered by a 125-hp., six-cylinder gasoline engine. Average progress was about 300 ft. of trench per day. Part of the spoil was removed by a fleet of motor trucks and the remainder cast along the top of the trench for later use as backfill.

The feature of the job was the close

DOUBLE ROW OF BUCKETS enabled trencher to excavate 300 lin.ft. of trench, 80 in. wide and 9½ ft. deep, daily.

coordination of the trenching, pipe-laying, jointing and backfill operations, as illustrated in the photograph at the top of the page. On the heels of the excavator came a crawler-mounted pipe-laying crane, followed in order by a concrete paving mixer with inclined chute and a Buckeye backfiller. This

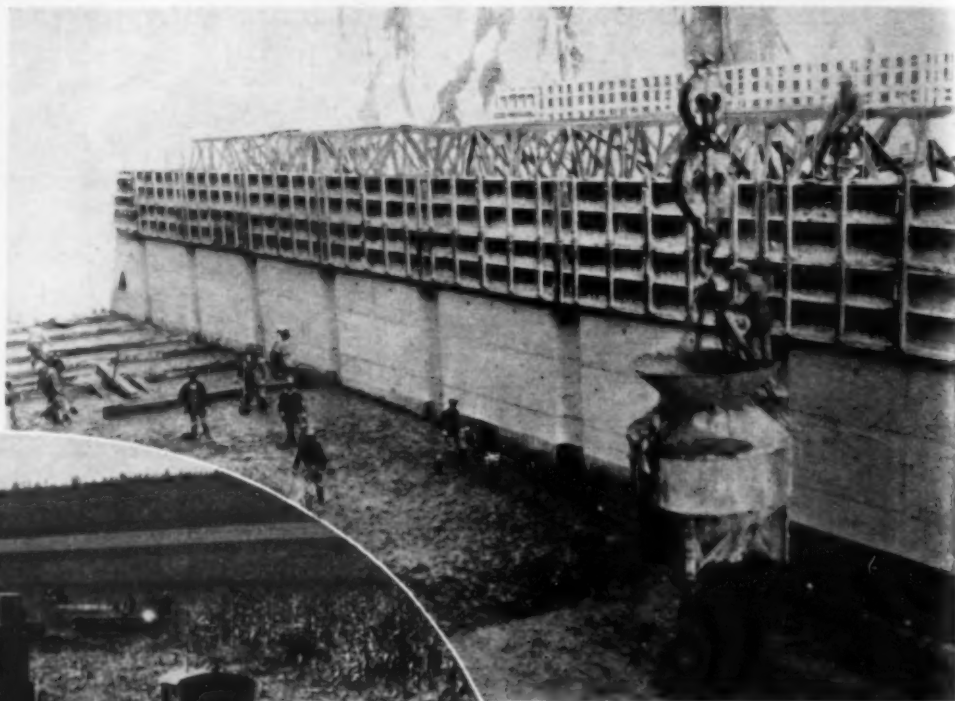
close sequence of operations, involving a distance of only 250 ft. between the trenching machine and the backfiller, enabled the contractor to open up a minimum length of street and quickly to restore the surface, thus interfering only slightly with the movement of traffic.



© P. J. A.

This Month's "News Reel"

CABLEWAY BUCKET (right), holding 8 cu.yd., deposits concrete in central panel of Owyhee dam. View shows forms and contraction joints in 522-ft. high structure being built by General Construction Co. for U. S. Bureau of Reclamation.



ELECTRIC WELDING (below) with 36 portable Lincoln gasoline powered machines joins lengths of 24-in. pipe to form 1,000-mile natural-gas line between Texas Panhandle and Chicago.



NEW ADMINISTRATION BUILDING for U. S. Department of Agriculture is completed at Washington, D. C., and illuminated by flood lighting.



JAPAN'S FIRST MOTOR SPEEDWAY was recently opened to traffic. The route, involving some heavy sidehill cuts, connects Ofune and Kamakura.



CLOSURE of 1,650-ft. arch span of Sydney Harbor bridge, Australia, terminates spectacular steel erection achievement by Dorman, Long & Co., contractor, of London, England.



SETTING FORMS (above) for Cow Creek siphon on \$6,000,000 project for power and irrigation, under construction in Maverick County, Tex., by Ulen & Co., of Lebanon, Ind. Dragline, in background, is excavating main canal.



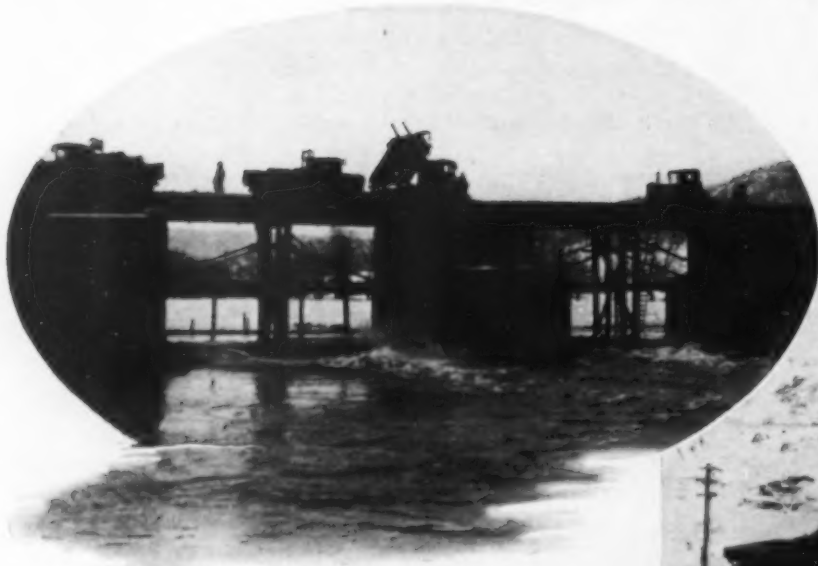
DREDGE IS CHRISTENED before reclaiming 280 acres of land for industrial sites at Islais Creek, San Francisco. City Engineer O'Shaughnessey observes ceremony of starting work.

©P. 4A.

BATTER - PILE DIKE (right) is built by U. S. Engineer Corps to regulate flow of Missouri River at Lexington Bend.



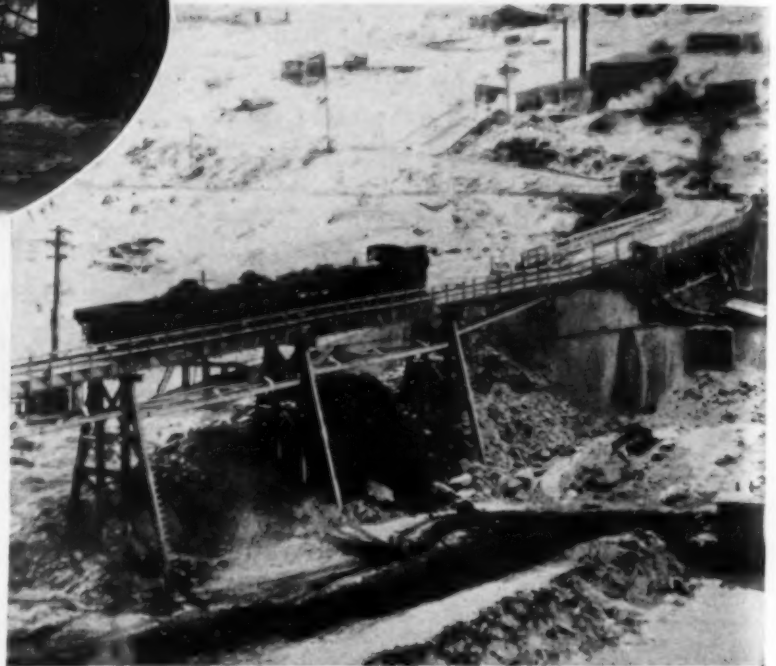
Tractors, Truck-Tractors 2,500,000-YD.



TRUCK-TRACTORS build upstream rock toe, crossing river on 24-in. I-beam bridge.

THREE types of automotive equipment hauled the material for the 2,500,000-yd. earth fill at the Wyman dam, on the upper Kennebec River, near Bingham, Me. Standard-gage railway, used to place 50,000 yd. in the downstream rock toe, represented a fourth and distinct class of hauling equipment employed in building fill. Apart from the earth-fill operations, the aggregate plant and mixing plants necessary to produce 260,000 yd. of concrete for other portions of the project contained many unusual features of interest.

Description of Project—As indicated by the plan, the Wyman develop-



STANDARD-GAGE RAILWAY places 50,000 yd. of rock in downstream toe by dumping from trestle 40 to 50 ft. high.

ment of the Central Maine Power Co. comprises a combination earth-fill and concrete dam and a three-unit power plant. The dam, which raises the level of the river 135 ft., has a total storage of 8,500,000,000 cu.ft. and a draw-

down capacity of 2,500,000,000 cu.ft. Each of the three generating units ultimately to be installed will develop 34,000 hp. The first of these units went into operation Dec. 24, 1930.

The earth-fill portion of the dam,



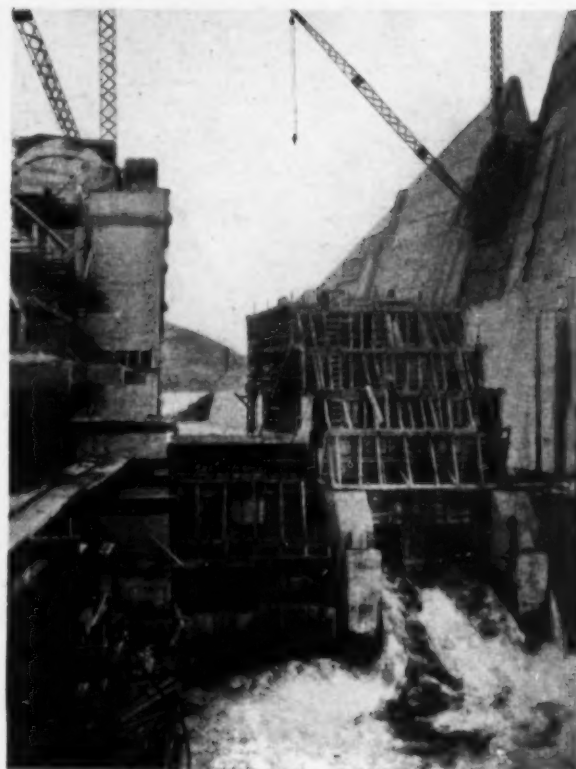
WYMAN PROJECT consists of spillway (in foreground), power house, retaining wall, and 2,500,000-yd. earth fill containing concrete core wall. At extreme left and right are upstream and downstream bridges across first temporary waterway. Material for fill is excavated outside limit of photograph to right. Derricks handle concrete buckets and form panels.

and Trucks Make EARTH FILL at Wyman Dam

approximately 2,250 ft. long, contains a concrete core wall carried to bed-rock. As described in *Construction Methods*, July, 1930, pp. 38-39, most of the core-wall foundation had to be constructed by the pneumatic-caisson method. Many of the caissons went down over 100 ft. to reach ledge.

General Construction Program—The Morton C. Tuttle Co., of Boston, Mass., is the contractor for the construction of the project. Working in conjunction with the engineers of the Central Maine Power Co., under whose direction all plans are formulated and executed, a construction program was worked out to take advantage of the seasons and river stages and to put one unit in service at the earliest possible date.

FIRST TEMPORARY WATERWAY, passing between Unit No. 3, at left, and retaining wall, at right, has two 30-ft. channels and two 8x10-ft. sluices. Lake level is raised by closing channels in alternate 20-ft. lifts, with difference in elevation of 10 ft. between alternate lifts.



Hydraulic records of the Kennebec River indicated an average low-water flow of 3,000 sec.-ft. and a maximum flood of 50,000 sec.-ft. Starting work in the fall of 1928, the constructors

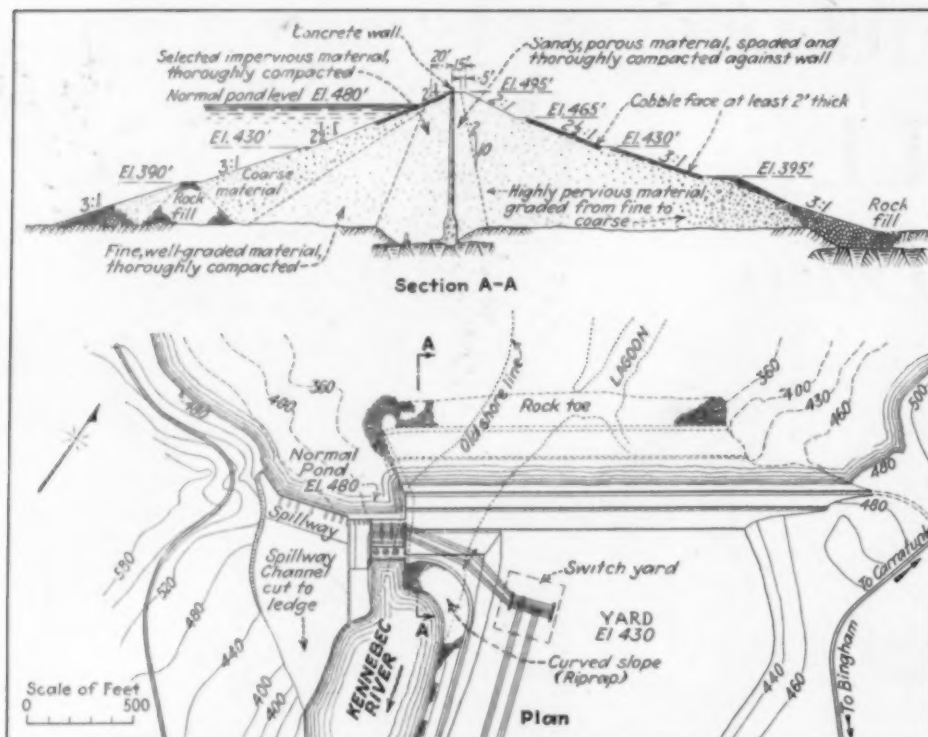
kept the river in its old channel until the fall floods of 1929 had passed, when they diverted the flow and raised the lake level without serious difficulty.

One of the operations in the first stages of the construction program was to complete the core wall near the east abutment, where rock foundation could be reached by open cut, and to start the earth fill on this portion. At the same time, workmen carried on rock



DECK-TRUSS BRIDGE (left) carries motor and railway traffic across first temporary waterway. In background is part of cantilever bridge for construction railroad. **COFFERDAM** (below) protects retaining wall and power house during early stages of construction.





PLAN of project and section of dam. River flows in old channel until diverted to temporary waterway through power-house area to allow completion of core wall and earth dam.

excavation west of the channel for the retaining wall, power house and tail-race. Earth-fill operations were suspended for two months during the winter of 1929-30; but retaining wall construction and spillway rock excavation continued.

Near the date of completing the core-wall foundations, the river was diverted through the 90-ft. construction waterway between the retaining wall and power-house unit No. 3, installation of which already had begun. As the builders increased the height of the dam and spillway, they raised the

lake level 50 ft. by closing the temporary waterway in 10-ft. rises. The river then passed through the second temporary waterway, in the spillway section. During the present winter, after the closing of this second waterway, all the flow has been discharged through a permanent 8x10-ft. sluice in the non-overflow section between the power house and spillway.

Earth Fill—Material for the earth fill came from a great bank of glacial drift on the east side of the river below the dam. Because of the variable

character of this drift, it was necessary to have loading and hauling equipment which could change quickly from one pit to another. Relatively small crawler-mounted shovels for digging, and tractors, truck-tractors, and trucks for hauling, had the flexibility to meet this requirement.

The cross-section of the dam shows the classification of materials used in the fill. Working two shifts of 11 hours each, the earth-moving equipment averaged around 10,000 yd. of compacted fill per day during the summer of 1930. July 17 is an example of a good average day.

On this day six shovels were operating in the pits. Of the shovels, five were Marions; two 2-yd. electric, two 1½-yd. steam, and one 1½-yd. steam. The sixth excavator was a 1-yd. Northwest gasoline machine. One of the electric shovels operated only about one-half of this day.

Hauling Records—Linn tractor-trucks pulling Linn trailers or Smith wheeled dump-wagons, Caterpillar 60-hp. or Monarch 75-hp. tractors with Smith wagons, and Sterling and Mack trucks hauled from the pits to the fill. The Linns could pull two 5-yd. wagons or one Linn trailer, in addition to hauling their own loads; the tractors drew two Smith wagons. No trailers were used with the trucks. On July 17, the equipment listed in the following table hauled 2,582 loads, equal to 10,328 yd. of rolled fill. (An average load contained 4 yd. of fill.) The second section of the table gives the round-trip distances traveled, and the number of loads delivered by the various categories.

Name of Machine	Total No. in Use	Average No. in Use	Average No. Disabled
Linn.....	7	5½	1½
Caterpillar, 60-hp.....	9	7½	1½
Monarch, 75-hp.....	10	8½	1½
Sterling, 5-ton.....	5	3½	1½
Mack, 5-ton.....	5	3½	1½

Name of Machine	Average Round-Trip No. in Use	Distance, Miles	No. of Loads—		
			Day	Night	Total
Linn.....	5½	1.5	168	239	405
Caterpillar, 60-hp.....	7½	0.8	298	330	628
Monarch, 75-hp.....	8½	0.8	465	508	973
Sterling, 5-ton.....	3½	1.8	128	143	271
Mack, 5-ton.....	3½	1.5	130	175	305



TWO-WAY DUMP permits tractor-trucks to be used with trailers. Because of its great power, tractor-truck can pull two 5-yd. dump wagons, in addition to hauling own load.

SIDE- AND END-DUMP (right). Tractor-truck and trailer spill loads two ways.



TRUCKS (right) haul gravel for fill on upstream side of dam. Trucks are effective on longer hauls.

COMPARATIVELY LIGHT SHOVELS (below) and automotive hauling equipment make flexible earth-moving units for quick changes of loading points in variable glacial drift.



Although July 17 was a typical day, no general conclusions can be drawn from its records as to the relative performance of different kinds of hauling units. Other weather conditions alone would have been sufficient to change the relative efficiencies of the machines. The records cited, of course, give no indication of relative costs of moving material on this day.

Rock Toes—Rock from excavations for the power house, tailrace and spillway went into the toes of the dam. Standard-gage railway equipment placed 50,000 yd. in the downstream rock toe by dumping from a trestle; Linn tractor-trucks built the upstream toe. The results obtained by these two methods convinced the construction engineers at the dam that for hauls of $\frac{1}{2}$ mile or less, tractor trucks are more efficient and more economical than railways.

Concrete Plants—All concrete was placed by bottom-dump bucket. Of the total quantity of 260,000 yd., 60,000 yd. went into the core wall. A small plant on the east side of the river was equipped with a 1-yd. Smith mixer and 150-yd. bins to produce this quantity of concrete. Trucks hauled the loaded buckets from the plants to the wall, where crawler cranes handled them into the forms.

On the west bank, a larger concrete plant, containing three Smith 1-yd. mixers and bins of 1,000-yd. capacity, supplied the 200,000 yd. for the retaining wall, power house and spillway. Buckets were hauled from this

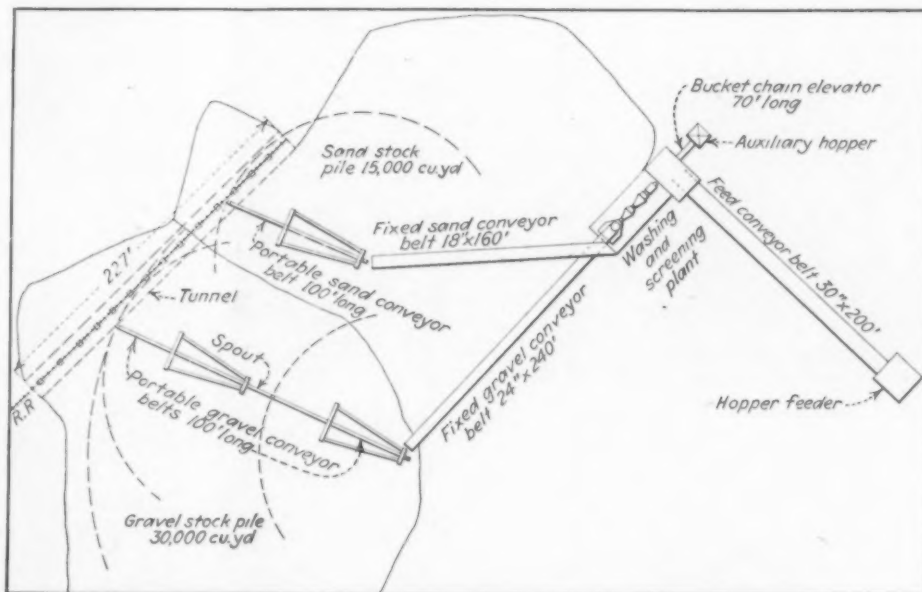
plant on narrow-gage flatcars. The narrow-gage track at the dam was located at three different levels during successive stages of concrete construction. To keep the grades to these three levels within practical limits, the concrete plant was located some distance downstream from the dam.

The design of the plant embraced several features of unusual interest. Only two mixers were operated simultaneously, the third being a spare unit to maintain production in case of a breakdown of one of the others. Cars carrying the concrete buckets were spotted below the mixers on two tracks

laid parallel with the axes of the three mixer drums. The middle mixer discharged through the two parts of a two-way chute to both tracks. Each of the other mixers chuted to only one track.

Of particular interest was the method of moving aggregates from the 1,000-yd. storage bins to the charging hoppers above the mixers. Standard-gage cars hauled sand and gravel from the screening and washing plant and dumped them into the bins, which were 40 ft. wide and 144 ft. long. These standard-gage tracks were practically on the same level with the mixers. Aggregates passed from the storage bins into a measuring car and thence into a skip car which traveled up an incline to dump into the charging hoppers. Two similar arrangements of measuring cars and skip cars served the three mixers, each skip car dumping through a tipping chute into the hopper of either the middle mixer or an outside mixer.

The rails of the track carrying the measuring car rested on brackets at



PLAN OF AGGREGATE PLANT. Portable belt conveyors take material from fixed conveyors and store it in stockpiles. Cars are loaded in tunnel.

tached to the 12x12-in. posts supporting the bins. The operator of the measuring car moved it to any of the twelve bin gates for loading, and spotted it to discharge into the skip car, by means of an endless moving cable. He always could spot his car at the same point to load the skip car.

A double-drum hoist operated the two hauling ropes which raised and lowered the skip cars. The ropes were marked to enable the hoist operator to spot the cars for loading. At the top of their run, the cars tipped automatically to charge the hoppers.

Gravel Plant—A standard-gage railway connected the concrete plant with the gravel plant, about $\frac{1}{2}$ mile distant. As shown by the plan, the 20-yd. standard-gage gravel cars were charged through the fourteen gates in a trap tunnel under the stock piles. Portable belt conveyors radiating from the end of fixed sand and gravel conveyors covered a large area and permitted storing of sufficient material to tide over any period of shutdown caused by accident or cold weather. As a matter of fact, the washing and screening plant operated through some of the coldest winter weather of 1930. A crawler crane and the portable conveyors rehandled material from the outer portions of the stockpiles to the tunnel when necessary.

Gasoline shovels loaded the gravel into side-dump railway cars for delivery to the conveyor feeding the screening and washing plant. The rail-

forms were in one section, 50 ft. long by 10 ft. high, with the two facing panels yoked together. As the photograph shows, the forms traveled on track supported by brackets. When one lift of the wall had been completed, a crane raised the forms in two parts, each 25 ft. long, to the next lift above.

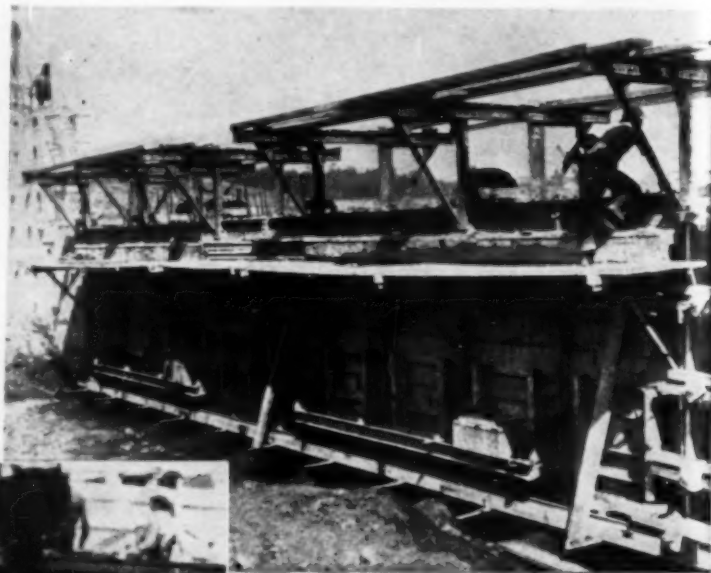
Wood forms for the retaining wall,

erecting and stripping the forms.

Drain Hole Kink—To form continuous 4-in. vertical holes at the joints in the concrete sections (the holes later to be filled with asphalt to act as water stops or left open to serve as drains) the constructors made effective use of a product designed for another purpose. By embedding Thomas

STEEL FORMS (right) for core wall travel on steel rails supported by brackets.

BOTTOM-DUMP BUCKETS (below), handled by derricks, place all concrete.



DIRECTING OPERATIONS. (Left to right) F. E. PREBLE, assistant superintendent, Morton C. Tuttle Co.; H. L. BAKER, resident engineer, and J. B. DOWNEY, assistant resident engineer, Central Maine Power Co.; W. H. RYERSON, superintendent, Morton C. Tuttle Co.

way and shovel arrangement was flexible enough to cover the large area of shallow gravel deposit, maximum depth of which was no more than 10 ft.

Concrete Forms—Blaw-Knox steel forms for the core wall reduced the form cost for this construction to at least one-fourth that of wood. The

spillway and power house were heavy panels, 8x8 ft. in size, handled by the derricks. Except on exposed surfaces, the builders burned off the rods holding the forms and sealed the surface of the concrete with asphalt compound. Edgecomb form clamps, with a tapered key as the locking device, proved very satisfactory in

E. Murray rubber conduit in the first lift of concrete and pulling it up 8 or 10 ft., depending upon the depth of the succeeding pour, a continuous hole was formed through the two layers. The process was repeated for each lift to the top of the structure. As workmen pulled upon the rubber conduit embedded in the concrete, the conduit stretched, broke its bond, and allowed the men to draw it up as far as necessary.

Electric Power For Construction—Electric power to operate all stationary plants as well as many portable machines on the project was brought in from Madison, 20 miles from the dam site. A transformer station, to reduce the high transmission voltage to 2,300 v., and 10 miles of light and power lines served the job itself. Local transformers reduced the voltage as required for various uses.

The second unit of the Wyman station will be ready for service some time this year. Installation of the third unit will await the development of a larger power market.

Personnel—In charge of construction for the Central Maine Power Co. are H. L. Baker, resident engineer, and J. B. Downey, assistant resident engineer. For the Morton C. Tuttle Co., W. H. Ryerson, superintendent, and F. E. Preble, assistant superintendent, direct operations.

Lumber for Apartment Partition Walls Serves

DUAL PURPOSE

A DEPARTURE from standard construction for apartment partition walls, involving a more effective use of lumber, has been developed in the offices of Schack & Young, architects and engineers of Seattle, and is being used for the first time in an apartment under construction in Seattle by Jack Owsley, contractor, according to the West Coast Lumberman's Association. The partition lumber of 2x6-in. tongued-and-grooved Douglas fir, cut to length, is first used as shoring, bracing, stringers

The economic feature of this construction practice, it is pointed out, is that all of the floor formwork is used up in the partitions. A single 2x6,

well braced, supports an area of about 15 sq.ft. Stiffening the entire construction a row of 2x6's, doubled, is carried down the center of the span.



FIRST USE of partition wall lumber is for shoring and bracing during concrete construction.

and soffit boards for reinforced concrete construction and later taken down and built into a mill construction partition.

The typical partition consists of the 2x6 set up vertically to make a solid 2-in. wall which is covered with sound resisting material on each side and plastered. For minor partitions the wall may be lathed with good lath. Where wood lath is used it is furred out by lath strips set vertically at about 16-in. centers and the whole nailed through to the 2x6-in. core.

This construction is claimed to be fire resistant, there being no hollow spaces except those occasionally encountered for housing pipes and ducts. The partition is also resistant to sound transmission.



CUT TO LENGTH the lumber consists of 2x6-in. tongued-and-grooved pieces of Douglas fir.



AFTER LATHING the partition wall receives a coat of plaster.

FINAL USE of lumber is for solid 2-in. partition wall, resisting sound transmission.



WITH a single span of 400 ft., the Jacks Run bridge, one of nine structures built by Allegheny County as part of a new $3\frac{1}{2}$ -mile highway in the valley of the Ohio River near Pittsburgh, Pa., takes rank among the longest concrete arches completed in this country. The design of the huge span provides for two arch ribs 8 ft. deep at the crown, and the construction presented special problems of steel centering.

Work on the nine bridges involved in this new highway route (five of concrete and four of steel) was covered by a single contract awarded in July, 1929, to Booth & Flinn, Ltd., of Pittsburgh. For the shorter spans of from 150 to 219 ft., on three of the concrete bridges, forms were handled and concrete placed by derricks with 150-ft. booms at each end, operating from the approach deck spans. The great 400-ft. length of the Jacks Run span, however, required the use of a $2\frac{1}{4}$ -in. cableway to set the steel centering and forms and handle 3-yd. concrete buckets.

For the five concrete bridges in-

cluded in the contract and scheduled for construction in sequence, forms for arch ribs and spandrel columns were designed for transfer, practically without modification, from one structure to the next one built. With slight alterations the steel centering also was designed by the Blaw-Knox Co. to permit of similar interchange. The contractor's schedule called for constructing the 400-ft. Jacks Run arch

last and for using on that structure all of the steel concreting forms which had served on the smaller arch spans of the other four bridges. Additional formwork, or centering, supported by steel trusses, was erected to produce the true contour of the intrados of the Jacks Run arch. The accompanying photograph illustrates how the problem of utilizing the steel centering was solved and shows also the towers of

STEEL
*After Previous Service on
Economically*

JACKS RUN 400-FT.



CENTERING

*Smaller Bridges, is Re-Used
in Concreting*

SINGLE ARCH SPAN

the cableway that served in setting the forms and delivering the concrete.

To insure the early completion of the five concrete bridges and minimize the time that the steel centering had to remain in place before being struck and transferred to another structure, the contractor decided to use high-early-strength concrete in the arch ribs. Cement specifications called for a tensile strength at one day (when

mixed 1:3 with Ottawa sand) of 275 lb. and, at 3 days, of 375 lb. Curing periods were reduced to approximately 30 to 40 hours, with attendant reduction in costs, by using a 1:2:4 concrete mix that developed from 1,800 to 2,100 lb. compressive strength in 24 hours. Centering was struck four days after pouring the arch-rib keyways, thereby effecting a saving of from 15 to 18 days per arch rib.

Arch ribs forms were built especially tight. Three-ply, $\frac{1}{4}$ -in. veneer board was used to cover 4x4-in. lagging, spaced 6 in. on centers, and served as the intrados surface form. The side forms were made of 2-in. tongue-and-groove lumber. All seams and cracks were carefully filled with sawdust and glue. Form oil was then applied. These precautions proved adequate insurance against leakages and gave a dense concrete surface.

Spandrel column forms were placed the day following the pouring of the arch ribs. Columns were poured from one to two days after placing the keyways with the result that the bridge deck forms were assembled and ready to be placed on the supporting columns at the time the steel centering was struck on the fourth day.

The project was carried out under the direction of the Allegheny County Department of Public Works, Norman F. Brown, director, and V. R. Covell, chief engineer, bureau of bridges. For Booth & Flinn, Ltd., the contractor, George Hockensmith, general superintendent, was in charge.



San Diego Uses **ARC WELDING** *on 19-Mile Pipe Line*



FOR TUNNEL SECTIONS (*above*) pipe was welded outside and delivered within by wheeled carriages. WELDING a section of the pipe line (*below*) at one of the tunnel portals. Gasoline-powered welding machine at left.

GROWTH, both in territory and population, of the city of San Diego, Calif., within the last 20 years has repeatedly brought that city face to face with the problem of furnishing an additional water supply. For this reason the city has recently made the third major improvement since 1914, the construction of a large pipe line known as the Otay-San Diego line, which is to deliver water from the Otay reservoir a distance of approximately 19 miles. This new line is

constructed of steel pipe fabricated by the electric arc-welding process.

The new steel pipe is to replace a wood-stave line which has been in service since 1901. It will have a somewhat greater carrying capacity due to its larger diameter and greater pressure capacity. The new line will bring water directly from the Otay reservoir to University Heights reservoir, and indirectly from the Morena and Barrett reservoirs on the Cottonwood River and the Lower Otay

reservoir on the Otay River. The old wooden line had a capacity of 10,000,000 gal. daily, but improvements at the Morena and Barrett reservoirs make it necessary for the new line to handle about 17,000,000 gal. daily. In the future booster pumps will be installed to raise this capacity to 25,000,000 gal. per day, two and one-half times the present capacity.

Approximately 86,000 lin.ft. of electric arc-welded steel pipe will be used in this new water line. About half of

this footage will be 40-in. and the other half 36-in. pipe. Varying thicknesses of plate ($\frac{1}{8}$ in. to $\frac{3}{8}$ in.) are used in the fabrication of this pipe. Of the 40-in. pipe about 31,000 ft. will be made of $\frac{1}{8}$ -in. plate; about 11,000 ft. of $\frac{1}{4}$ -in. plate; and 830 ft. of $\frac{3}{8}$ -in. plate. Of the 36-in. pipe 21,560 ft. will be $\frac{1}{8}$ -in. plate; 13,340 ft. of $\frac{1}{4}$ -in. plate; 4,910 ft. of $\frac{3}{8}$ -in. plate, and 3,100 ft. of $\frac{1}{2}$ -in. plate. These varying thicknesses were necessary to meet the varying pressure

requirements. All of the pipe used in this line was manufactured by the Western Pipe & Steel Co. of San Francisco.

In the construction of this line it was necessary to tunnel through four large hills. These tunnels were cut 6½ ft. high and 6 ft. wide. The longest tunnel is 2,150 ft. long. One of the illustrations shows a section of pipe being rolled into a tunnel after the welding had been done outside.

All the pipe used was of the electrically welded steel type, and with the exception of that for the tunnel, all was dipped in hot asphaltum and wrapped with special felted fabric. The pipe for the tunnels was dipped but not wrapped. When the city of San Diego asked for bids for the pipe, specifications for three kinds of pipe were invited: electrically welded steel pipe, cast-iron pipe and concrete. No bids were received for concrete pipe, and only one for building the line with cast-iron pipe.

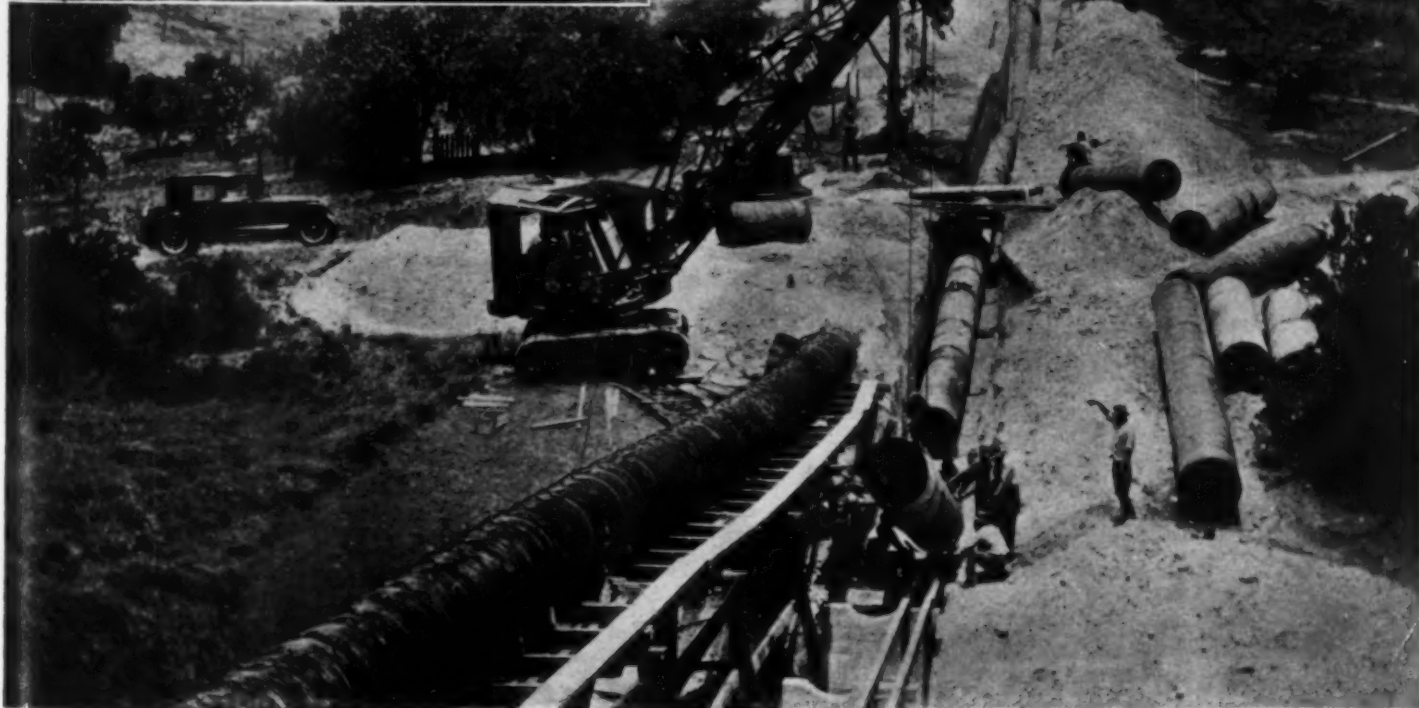
The pipe is equipped with bell-and-spigot joints, all arc welded. On the heavier pipe two beads are used, and all joints are welded both on the inside and the outside. The pipe sections, as a general rule, are about 30 ft. long, but vary with the terrain. Pipe is lined up and arc welded in sections, then tied into the main line. Stable arc welders, manufactured by the Lincoln Electric Co., Cleveland, Ohio, were used on this line.

The use of the electric arc-welding process in the fabrication of this line, it is claimed, not only kept the cost to a minimum but also made the line strong and rigid.



CIRCUMFERENTIAL JOINT (left) is made by tie-in weld at point where pipe line traverses rough terrain.

NEW WELDED PIPE LINE (in background, below), 19 miles long, replaces old wood stave pipe (in foreground) in service since 1901.



Reservoir LINED WITH CONCRETE

To Store 2,500,000 Barrels of Oil

TO PROVIDE storage capacity for the General Petroleum's new oil refinery at Torrance, Calif., the Robinson-Roberts Co., contractor of Los Angeles, has completed a 2,500,000-bbl. concrete-lined and covered reservoir. Under a construction plan of balanced cuts and fills excavation was done with elevating graders and power shovels loading into motor trucks which transferred earth from the base of the structure to the embankment forming the sides of the big bowl. The embankment earth was spread and compacted in 4-in. layers and was made oversize in order that its slopes could be cut and accurately trimmed to a uniform slope to receive the paving for the concrete lining. This slope cutting operation, as illustrated, was done with 7-ft. Fresno

scrapers operated by pull and back-haul cables from hoist drums.

After the floor had been concreted the embankment lining was done in alternate strips which were brought to the specified thickness by blade screeds operating on inclined timber guides.

The finish was done by hand troweling. From the mixer plant concrete was delivered by motor trucks operating on the top of the embankment.

The final operation was the covering of the reservoir with a concrete roof supported by vertical posts.



GRADING (*above*) of the reservoir site was done with power shovels and elevating grader loading into motor trucks



CONCRETE LINING was placed in strips on sloping side of embankment, screeded and finished by hand troweling.

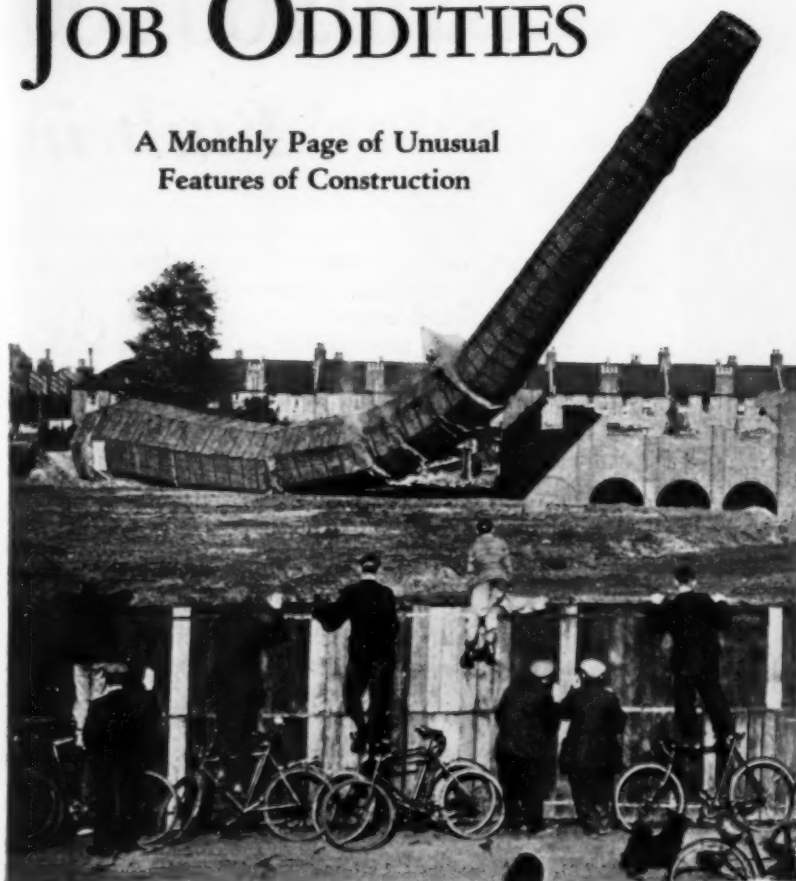
FRESNO SCRAPERS (*below*) operated by pull and back-haul cables from hoists, trimmed embankment to uniform slope for concrete lining.



FLOOR AND SIDE LINING are in place and construction is starting on concrete roof for 2,500,000-bbl. reservoir.

JOB ODDITIES

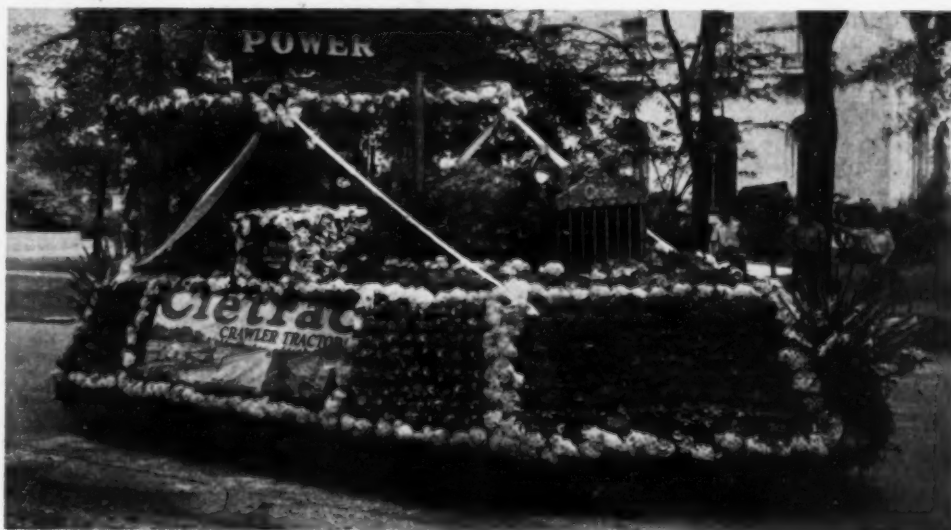
A Monthly Page of Unusual
Features of Construction



JUST BEFORE THE CRASH. Camera catches 150-ft. stack at Tooting, England, at critical point in its descent earthward. View clearly shows planes of rupture in masonry before the tall 800-ton column actually had struck the ground.



TRIANGULAR SECTION is novel feature of this German railway bridge over the Ruhr River at Dueren. The steel structure, with side trusses inclined to connect at top chord, has a span of 256 ft., bottom width of 44 ft. and height of 47½ ft.



DRESSED UP FOR PAGEANT (right). Cleveland tractor, with elaborate floral decorations, represents "Power" in 5-mile parade of industrial floats during week of national air races and exposition. The machine is a 100-hp. unit.



CROOKED BRIDGES (left), known as S-bridges, were built in Ohio more than 100 years ago and are now being replaced by modern structures. Among explanations for the freak design are an architect's enmity toward a contractor and an attempt to plan a structure he would not and could not build. Others claim that the curves were introduced for architectural effect. Still another version holds that the builder was paid by the linear foot and craftily added 20 ft. to the length of each structure by introducing a multiplicity of curves.—Photo from EARL V. MURRAY, Ohio State Highway Department.



MOVABLE STACKER, in wood storage yard, takes logs from chutes along conveyor trough and stores them in great piles.

IN LESS than 12 months after pouring the first concrete, Jan. 15, 1930, for a \$10,000,000 paper mill on the Penobscot River at Bucksport, Me., the Morton C. Tuttle Co., of Boston, Mass., general contractor, completed the plant and had it ready to manufacture newsprint. Starting work in the severest winter weather and maintaining progress at a high rate in spite of the difficulties of the season, an efficient job organization had construction well advanced when milder spring days arrived. By continuing to operate with the same efficiency and skill during the warm months, the contractor practically finished the job before the cold winds of a second winter began to blow.

Description of Mill—The Maine Seaboard Paper Co., owner of the mill, located the new plant on tidewater, where it could be supplied with spruce logs from Canada by ship in summer and by railroad in winter, when the Canadian ports are ice-locked.

A conveyor system 2,000 ft. long takes logs from the pond or from railroad cars and carries them to the wood storage yard or directly to the mill. The mill, which has a capacity of 250 to 300 tons of newsprint a day, consists of a number of connected buildings of varying widths and an aggregate length of 750 ft. Several of the buildings are large: the grinder room has four stories and is 90 ft. high; the digester house, with 5 stories, has a height of 120 ft.; and three acid towers, 10 ft. in diameter, are 120 ft. high. Total floor area of the buildings approximates 300,000 sq.ft. The Morton C. Tuttle Co., general contractor for all work except the installation of machinery, sublet the acid towers to the G. D. Jensen Co., New York City, and a wood-pile wharf 400 ft. long to the Carlton Co., Augusta, Me.

Early Operations—On November



TO TAKE LOGS FROM GREAT PILES and spread them over larger storage area or pull them into flume for delivery to mill, electric tower cableway machine, moving on rails, operates special drag scraper. **SPECIAL DRAG SCRAPER (right)**, with three pivoted teeth, pulls logs from great piles built by stacker and distributes them over storage space or deposits them in flume.



PAPER MILL, with capacity of 250 to 300 tons a day consists

February, 1931—CONSTRUCTION METHODS

\$10,000,000

Built in

27, 1929, the contractor started clearing the forest which covered the site of the mill. Seven power shovels were put to work excavating 20,000 yd. of rock and 57,000 yd. of earth. The shovels were 1 to 1½ yd. in capacity; two Bucyrus-Erie machines were steam-driven, and two Lorain's, two P & H's and one Northwest were gasoline-powered. Hired trucks dumped the spoil to extend land into the river.

Eight Sullivan portable compressors, five of 220-ft. and three of 110-ft. capacity, were moved about as needed, at first, thus keeping down the length of the air lines. Later, the eight machines were connected in series to form a stationary plant. The battery ran as many as sixteen Sullivan jack-hammers.

Central Mixing Plant—A central plant equipped with a ¾-yd. Koehring mixer operated by electric motor produced practically all of approximately 20,000 yd. of concrete required by the job. To prepare concrete for grano-

PAPER MILL

Twelve Months

lithic finish, a Rex 14-cu.ft. machine was placed in the mixing plant. Ford $\frac{3}{4}$ -yd. trucks hauled concrete from the plant to tower hoppers or, in the case of footings and foundation walls on the lower side of the mill, directly to the forms.

The building walls contained terra cotta, hollow tile, concrete tile, and cement brick, in addition to common brick. Expressed in common brick, the volume of the walls was equal to about 5,500,000. To elevate materials, the contractor used American tubular

TUBULAR TOWERS (right) in thirteen locations elevate concrete and other materials to upper floors of buildings.



FLOOR FORMS rest on timber joists hung from steel beams. Horses and panels are made up at two saw mills on job. **BAND-IRON HANGERS** (right) hold wood joists.



towers with Mead-Morrison or Lambert steam hoists. The towers first were equipped with platforms to hoist brick and similar materials and, then, were changed over to buckets for concrete. Thirteen tower locations, in all, were used; eleven towers were in operation at one time during construction.

Laborers with hand carts distributed concrete for most of the footings and

for the floors. Two saw mills on the job prepared the forms. The floors had a steel beam-and-girder framework. Joists to support the forms were suspended from the steel beams with Bosco band-iron hangers, and horses and panel forms were erected on the timber joists. The photographs illustrate the form construction.

Winter Methods—During the cold weather, a 125-hp. boiler at the central mixing plant heated a thawing shed for sand and gravel cars, raised the temperature of the material in the bins by live steam, and prepared hot water for mixing by means of steam coils in barrels. The green concrete was protected by tarpaulins and was heated by salamanders and live steam.

Water lines were connected to boilers, and live steam was turned through the pipes at night. The air line from the compressor plant was equipped at intervals with reservoirs 20 ft. long. By heating the air at these reservoirs, the contractor counteracted the loss of pressure due to cooling.

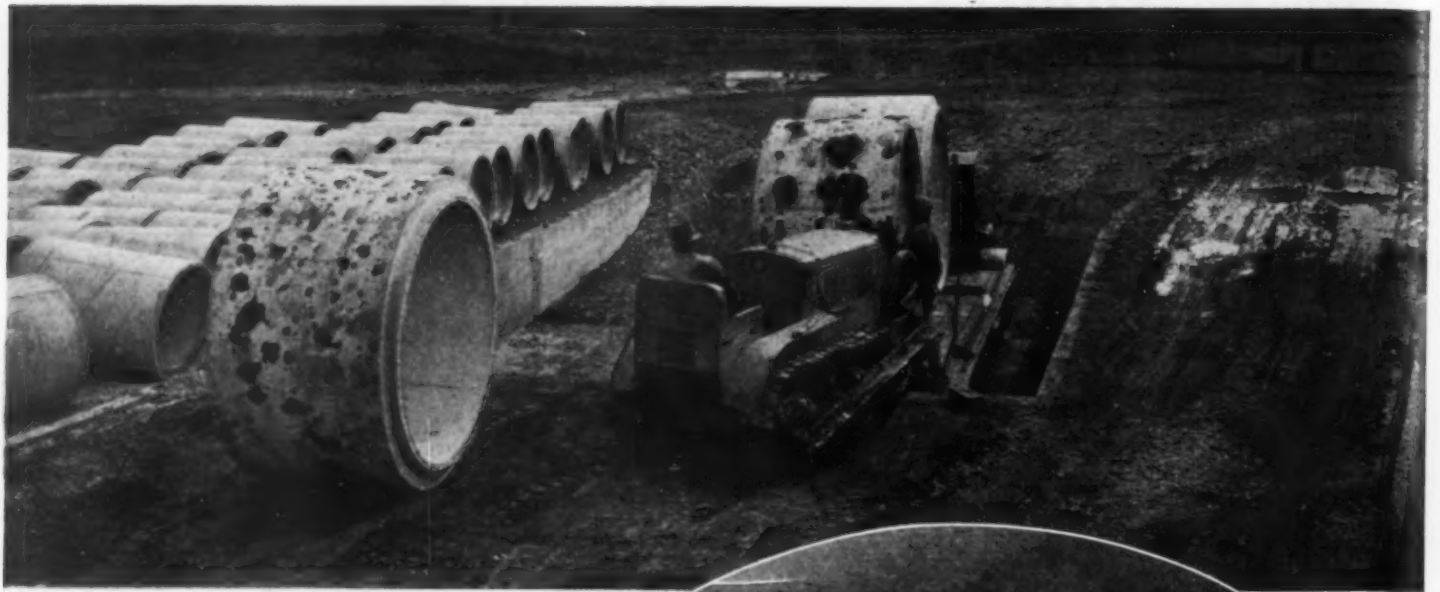
Prestone solutions, tested daily for density, protected all radiators from freezing, not one freeze-up occurring on the job. Little Prestone was lost through leaks.

Personnel—For the Morton C. Tuttle Co., R. H. Foss, superintendent, Thomas W. Proctor, resident engineer, and L. R. Ancill, purchasing agent, directed operations in the field.



of group of connected buildings ranging up to 120 ft. in height.

Getting Down to DETAILS



LOADED BY ROLLING. Precast concrete pipe in large sizes is pushed by Caterpillar tractor on to motor truck in pit at plant of Lock Joint Pipe Co. at Ampere, N. J.

©P4A

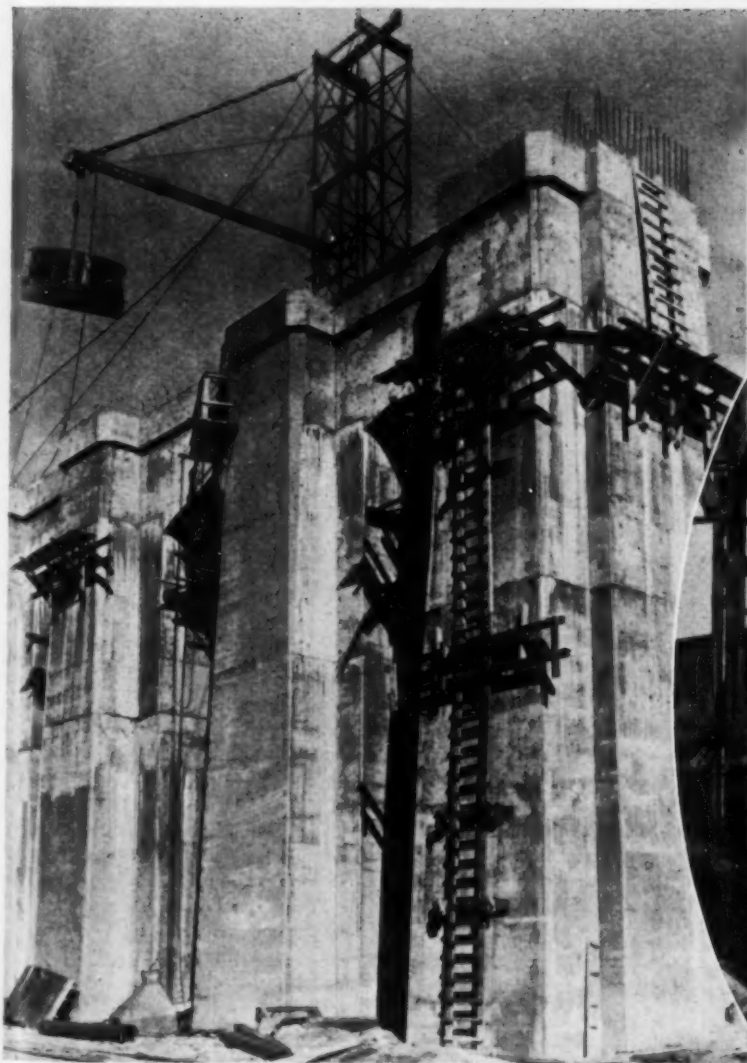
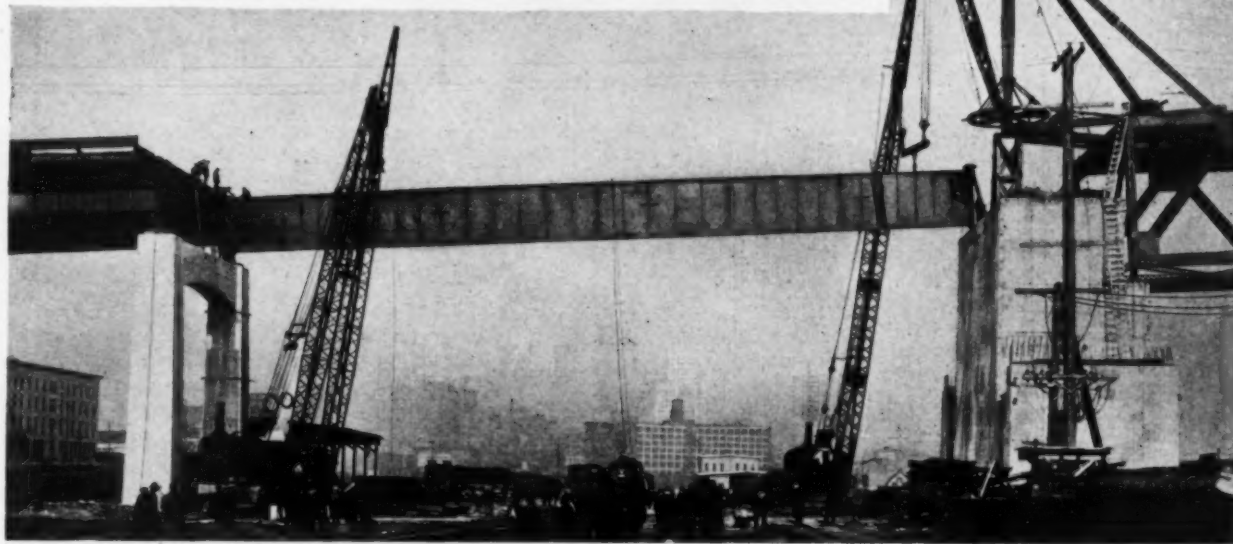


ADDITIONAL BEARING AREA and traction, provided by Trucktor tracks on rear wheels, enables this Ford truck to haul a heavy load through a mud hole for Frank A. Ursitti, highway contractor, of Deposit, N. Y.

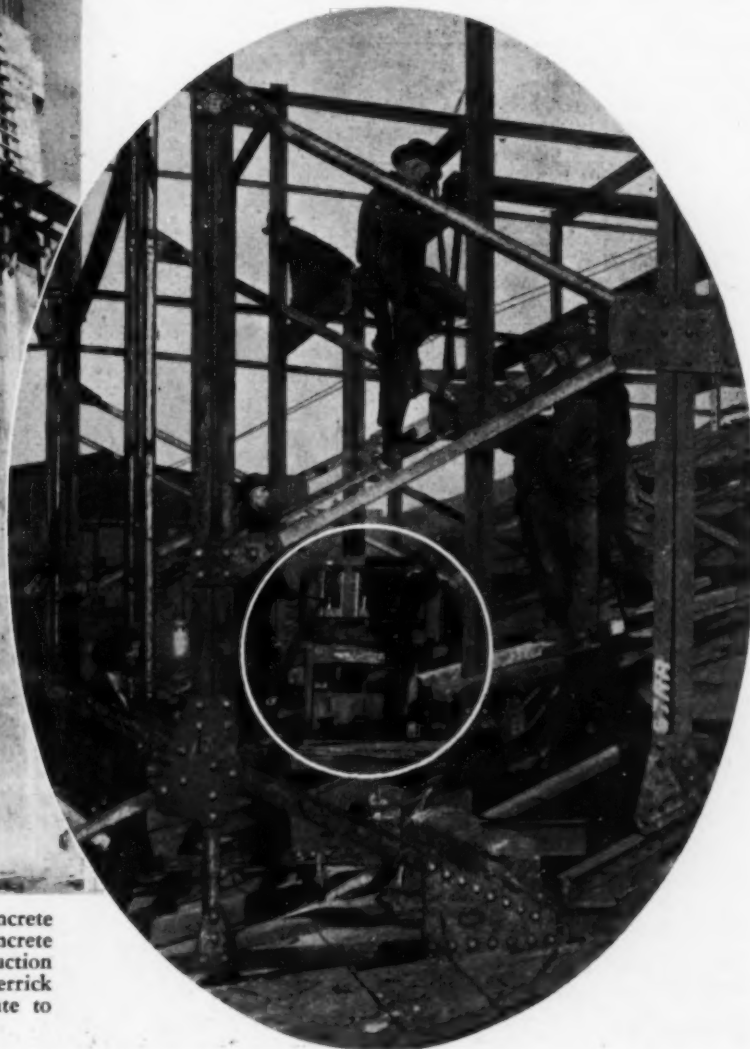


TURRETED TOWERS (*left*) suggestive of a medieval castle, feature the architectural treatment of the spillway and outlet works of the large masonry dam constructed at Pateley Bridge, Yorkshire, England, to supply water to Bradford and other towns.

TRICKY STEEL ERECTION. At Maumee River bridge approach, Toledo, two 154-ft. girders, each weighing 84 tons, are placed 70 ft. above ground by two 60-ton cranes with 80-ft. booms at one end and one 40-ton crane with 90-ft. boom, assisted by stiffleg derrick, at other end. Lengthened booms reduce crane capacities, requiring four pieces of equipment for safe handling.—*Photograph from G. A. CAFFALL, manager of erection, McClintic-Marshall Co., Pittsburgh.*

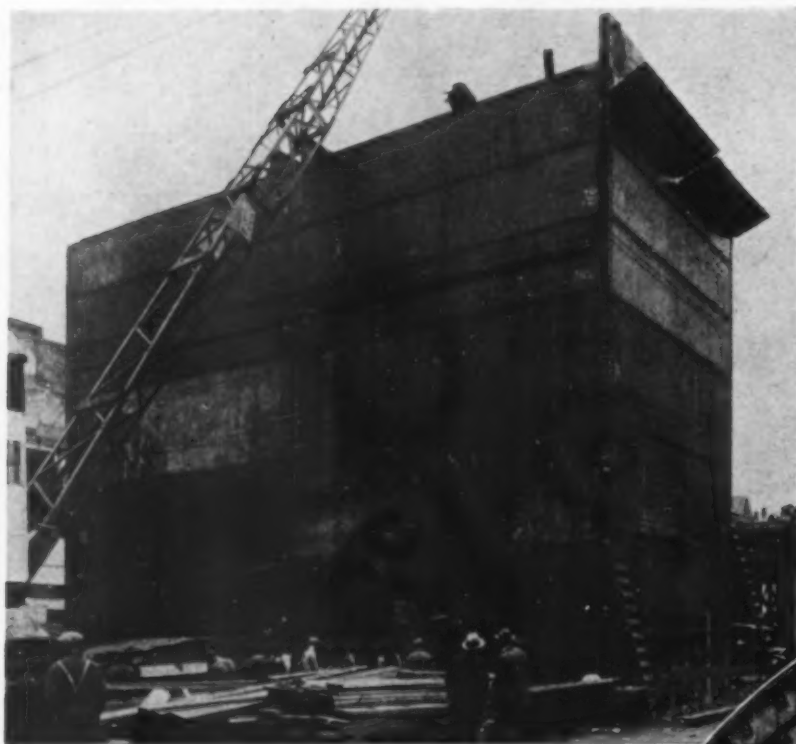


RIVETS HEATED ELECTRICALLY (*below*). American Car & Foundry Co. uses one of its three-electrode Berwick heaters on erection of steel structure at its Pennsylvania plant. No fuel, gas or smoke; uniform temperature control; elimination of waiting time for hammer gang; and low operating cost are among advantages claimed for heating rivets electrically.



DOUBLE DUTY is performed by this Lakewood tubular concrete hoist. It erects and dismantles forms in addition to chuting concrete on 85th St. Pier of Lorain-Central bridge for Lowensohn Construction Co., Cleveland. Concrete chute is shown rigged to serve as derrick boom. At times a stiff post is lashed to the end of the chute to extend its reach.

Building New York's Subways—VI



1 STEEL CAISSON at Manhattan shaft ready for sinking. On side of caisson can be seen outlines of two built-in drums through which shields will be shoved. Caisson, approximately 30x60 ft. in plan, will be sunk almost 60 ft. below water level. Cutting edge was laid in excavation, slightly below tidewater elevation, kept dry by pumps. During steel erection, caisson was lowered about 6 ft. From May 24 to June 13, caisson is sunk remaining 50 ft. to final position.

2 WORKING CHAMBER (*below*) of caisson during sinking operations. Soon after start of this work, caisson encounters old piles and cribbing. Concreting of caisson walls continues as caisson goes down. Behind pipe at top center is muck well. When down to position, caisson is sealed under about 27-lb. air pressure.



TO CONSTRUCT the land and water sections of the twin tunnels under the East River at Fulton St., Manhattan, the Mason & Hanger Co., Inc., general contractor, sank a shaft by the pneumatic-caisson method on each shore and advanced four shields, two in either direction, from each shaft. The diagram on the opposite page shows the location of the shafts and the principal features of the river section between them. The land tunnels extend far beyond the limits of the diagram, the length in Manhattan being 2,575 ft. and in Brooklyn, 2,745 ft.

Fabrication, erection and concreting of the two shafts was sublet to the Dravo Contracting Co., of Pittsburgh. Tunnel shields were manufactured by the Biggs Boiler Works, Akron, Ohio.

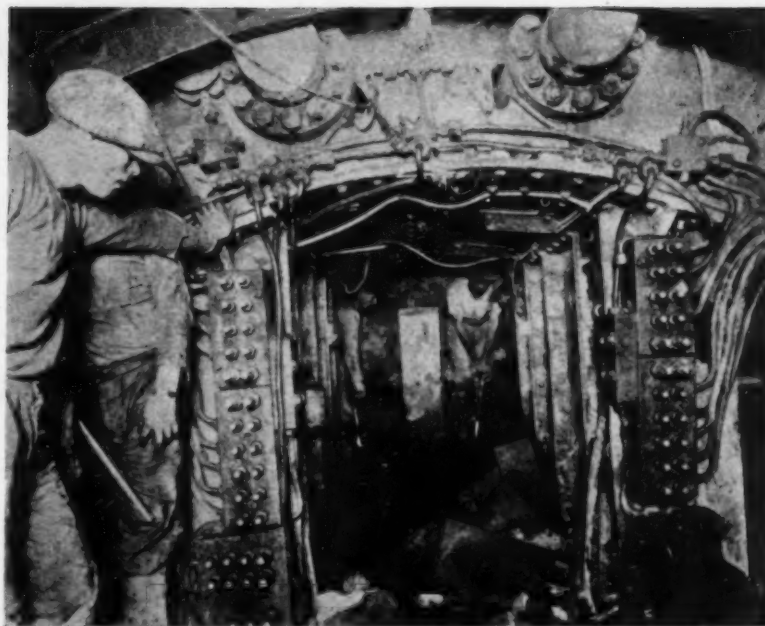
After installing air decks in the caissons, the shaft contractor sank them to position, sealed them, and removed the air decks. The Mason & Hanger Co. placed wood cradles in the bottom of each shaft,



3 AFTER SHIELDS HAVE ADVANCED some distance from shaft, they are bulkheaded with timbers and concrete to permit withdrawal of compressed air and construction of permanent bulkhead. Shield is built of welded and riveted structural steel, with cast-steel cutting edge and hood segments. It has three pockets above springing line and three below. Eighteen 10-in. hydraulic jacks can exert maximum shoving force of 4,200 tons. Erector, mounted at shield axis, is swung by rack and pinion control.

Pair of East River Tunnels Driven by Eight Shields From Two Shafts

erected two shields on the cradles, and replaced the air deck. After burning out the steel bulkhead in the wall of the caisson, the contractor shoved out the two shields and constructed enough tunnel to permit installation of the tunnel bulkheads. The shields were sealed with timber-and-concrete bulkheads to allow withdrawal of air pressure while constructing the tunnel bulkheads. With the bulkheads completed, the second pair of shields was erected in the shaft, the air deck was replaced, and the shields were shoved out of the caisson. When the bulkheads had been installed in these two tunnels, the air deck was removed for the last time.

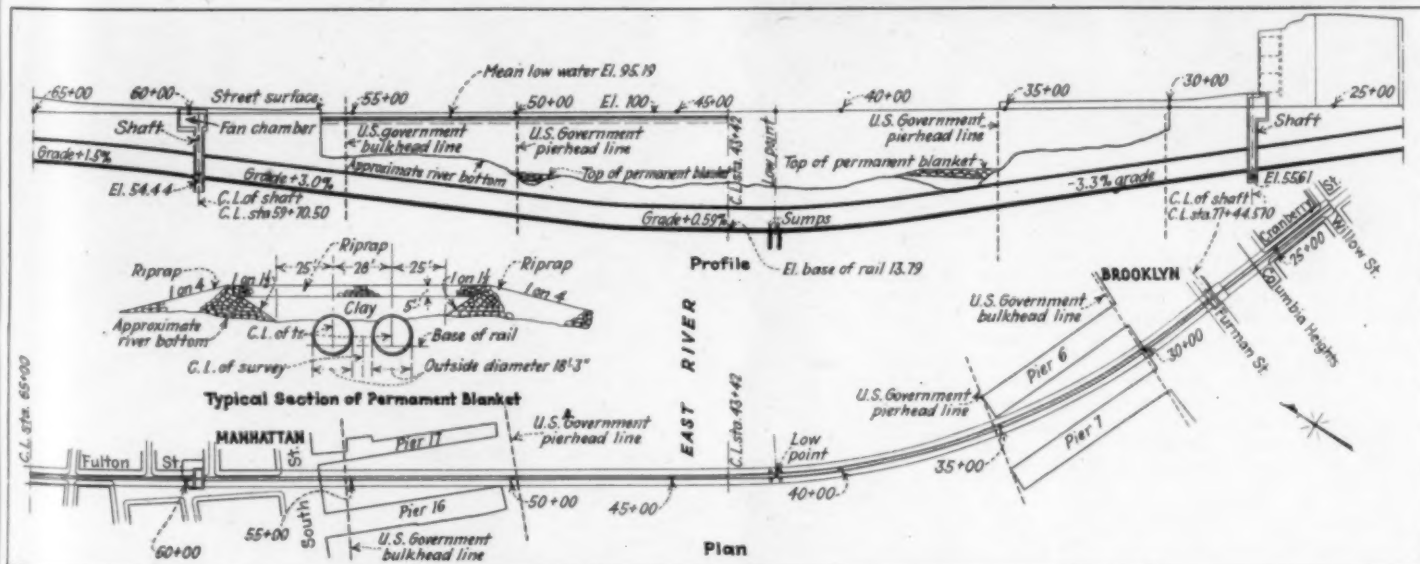
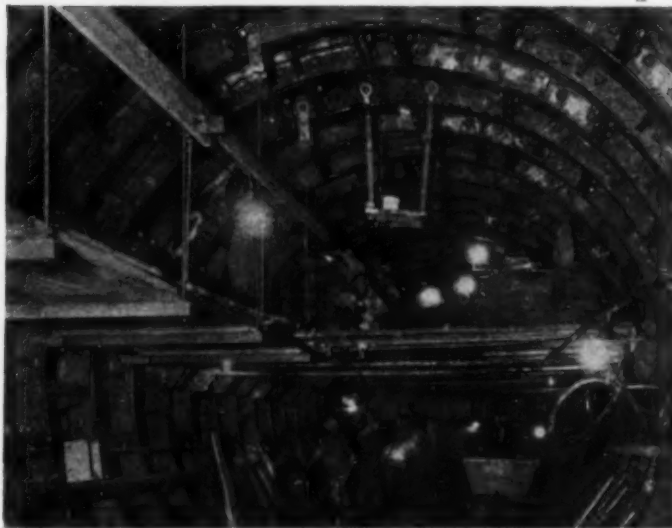


4 TYPICAL BREASTING OPERATION in upper pocket of shield. Workmen advance face $2\frac{1}{2}$ ft., width of ring of lining, beyond soldier which stands in position of old breasted face. Breastling is carried about 2 ft. below working table. Below this point, muck flows in on natural slope. Extension of working table can be moved forward on hydraulic ram. Valves on sides of pocket operate jacks and sliding tables.



5 CONCRETE TUNNEL BULKHEAD contains man lock, muck lock, and emergency lock. Bulkheads in river tunnels are 8 ft. thick and in land tunnels, 6 $\frac{1}{2}$ ft. thick.

6 BEHIND SHIELD (right) horizontal tierods correct tendency of cast-iron lining to flatten in mud. Working platform for calking and grouting rests on turnbuckle tierods. Flying gangway from platform leads to emergency lock and provides means of escape in case of flooding.

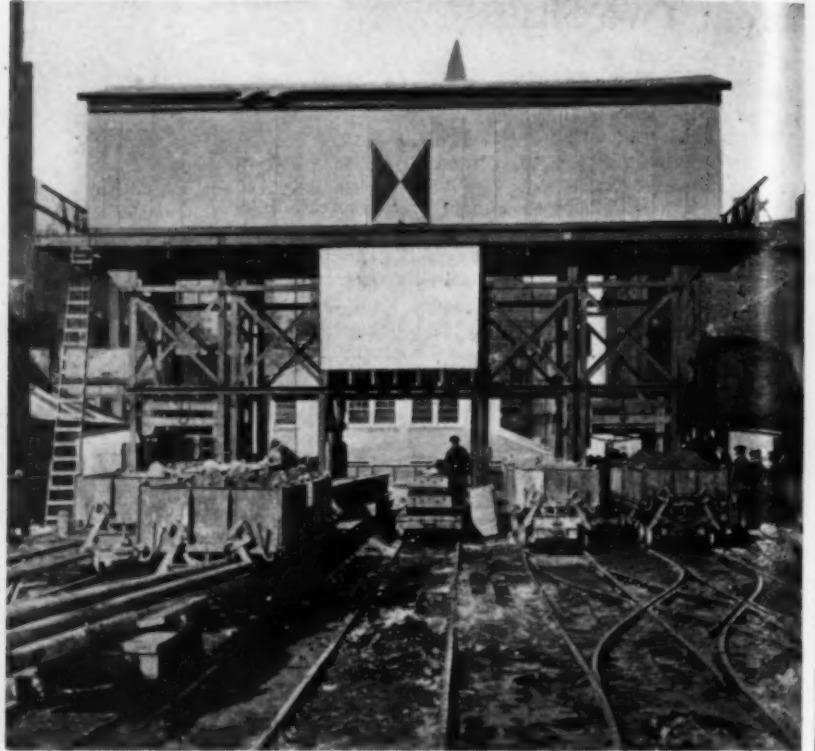


PLAN AND PROFILE of subaqueous section of Fulton Street subway tunnels under East River. In addition to permanent clay blankets, protected by riprap, much clay was dumped on soft river bottom over line of tunnels to prevent escape of air.

Building New York's Subways—Part VI (continued)



7 CALKING JOINTS between cast-iron segments with lead wire driven home by pneumatic tool. Behind workman is can used in blowing pea gravel to fill annular space of $3\frac{1}{2}$ in. outside iron lining. Graveling follows directly upon tail of shield.



8 HEADFRAME of Manhattan shaft and elevated railway platform leading to dump board on Pier 16. Penthouse contains electric hoists which operate four elevators. Two hoist tenders control four elevator platforms by means of push buttons. Flat car in center carries two cast-iron tunnel-lining segments. Five cars are required for nine segments and key section in one ring.



9 STORAGE-BATTERY LOCOMOTIVES on 36-in. gage track haul 2-yd. side-dump steel muck cars in tunnel and on elevated platform. Batteries are recharged each 8-hour shift. Recharging stations in tunnel are under automatic control from the platform at head of shaft where motor-generator set is located. MUCK CAR (*above*) dumps from elevated platform into scows alongside pier. MUCK TRAIN (*right*) is on way from shield to shaft. Progress in driving tunnel is largely dependent on speed with which motorman takes loaded car away from face and pushes in empty car.





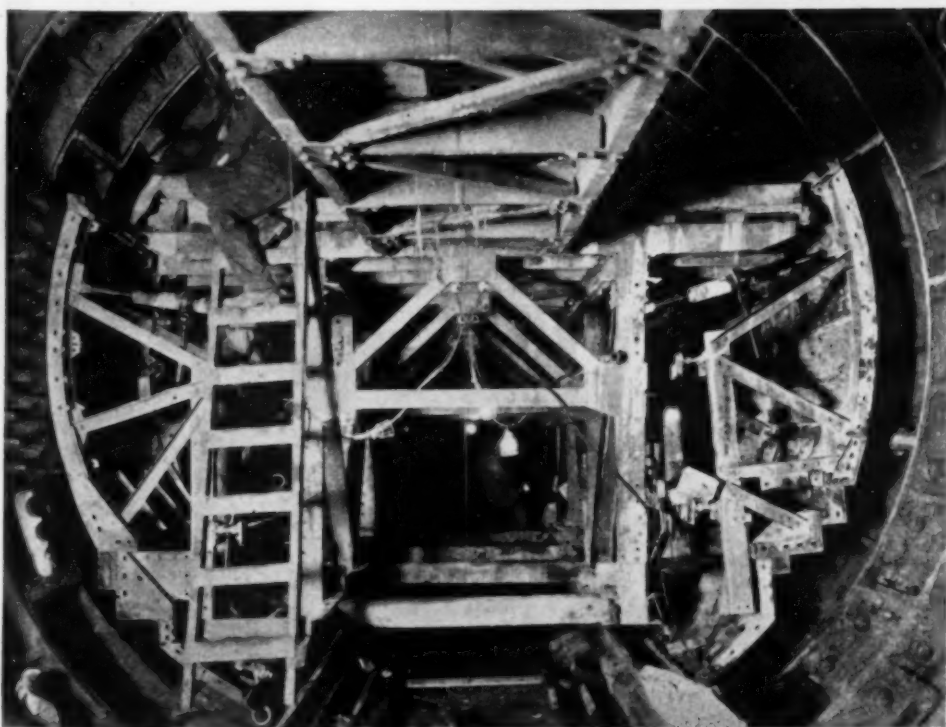
10 AS TWO SHIELDS APPROACH EACH OTHER, near middle of river, workmen place poling boards across hoods to keep out mud and permit removal of cutting edges. They are removing first installation of 2x8-in. wood poling, still in place at top, and are replacing it with 6-in. steel channel poling, to be seen in lower half of quadrant.



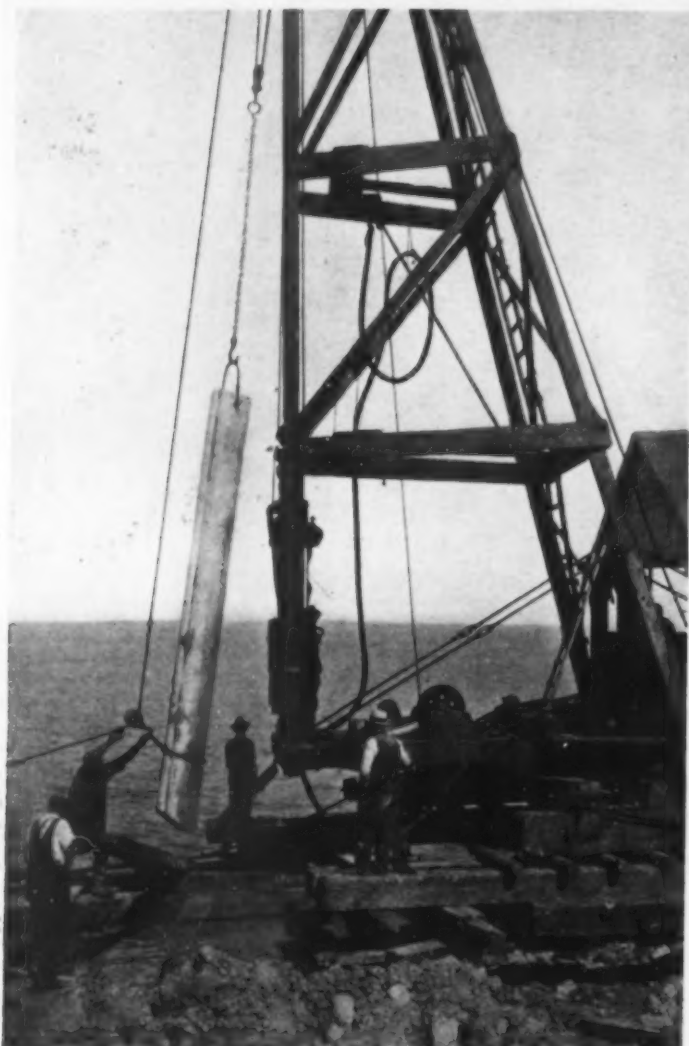
11 AFTER INSTALLATION OF STEEL POLING, cutting edges are shoved together, and workmen remove cast-steel cutting-edge segments, exposing hoods and poling.



13 AFTER CONCRETE LINING HAS BEEN COMPLETED (left), grouting crew drills holes in arch and fills voids by forcing in grout under pressure.



12 TO LINE INTERIOR OF TUBE with concrete, contractor uses collapsible steel forms. SIDE-WALL FORMS (left) are shaped to fit contour of tile ducts near bottom of wall. Note pipe ducts along left wall. MECHANICAL VIBRATOR (above) of Electric Tamper & Equipment Co., attached to form, works concrete into narrow spaces and aids consolidation.



AFTER CAREFUL SPOTTING between guide timbers to secure an accurate fit for the tongue-and-groove joints, the concrete piles are sunk by water jets along each edge and driven the final 2 or 3 ft. with a steam hammer.

SEA WALL

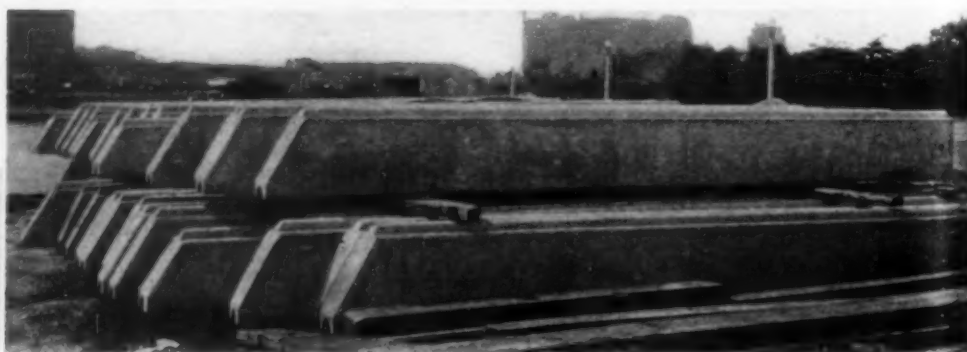
*Built of Precast Concrete
Sheet Piles With
Tongue-and-Groove Joints*

DURING 1929 Lake Michigan, in common with the other Great Lakes, reached a level approximately 4 ft. above normal. The height of the water was so great it overtopped the wood piling sea wall protecting the "made" ground in Lincoln Park, Chicago. During storms the waves worked far up on the shore and this water, running back through the opening between the piling, carried soil with it and washed out sidewalks, roads and beach pavement, doing thousands of dollars worth of damage. To prevent such damage in the future, a new, slightly higher, sea wall was built of precast concrete sheet piles having watertight tongue-and-groove joints.

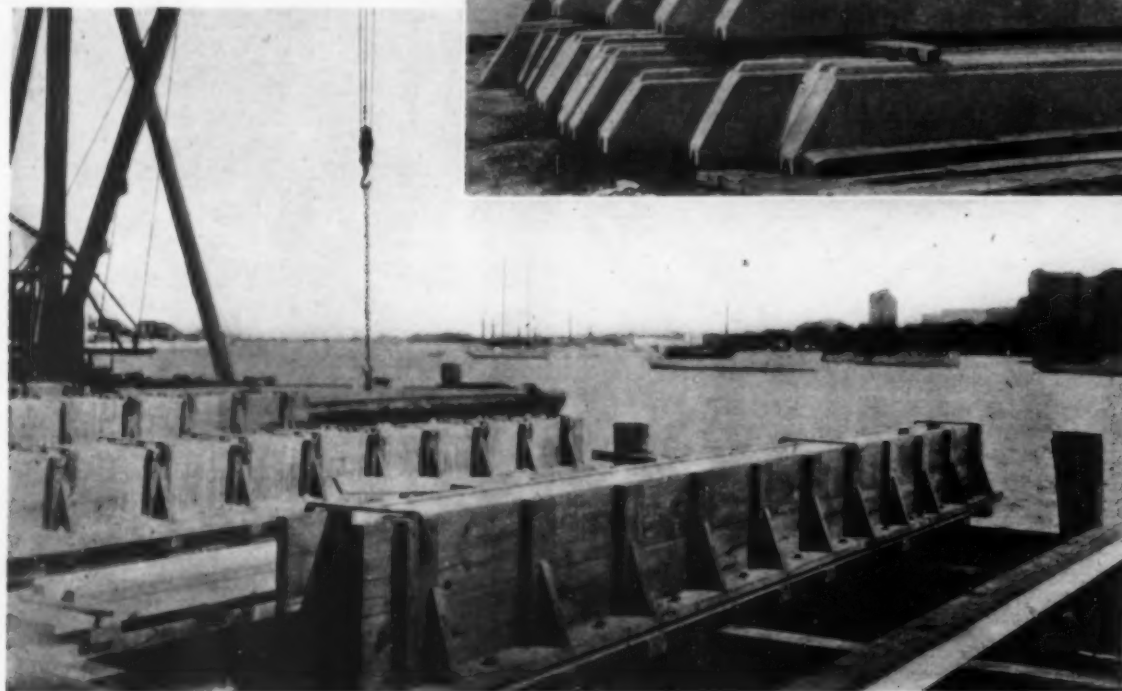
The piles were cast in a central yard in Lincoln Park by employees of the park at a cost of approximately \$8 each. The cost in place in the wall was \$26 per lineal foot of wall. Concrete for the piles was proportioned 1:2:4.

The forms used were lined with galvanized metal and held together at the top by strap clamps. Side forms were stripped after 24 hours, but the piling was left on its base 48 hours. In handling the cast piling with a crane, care had to be taken to prevent breakage of the tongue-and-groove edges.

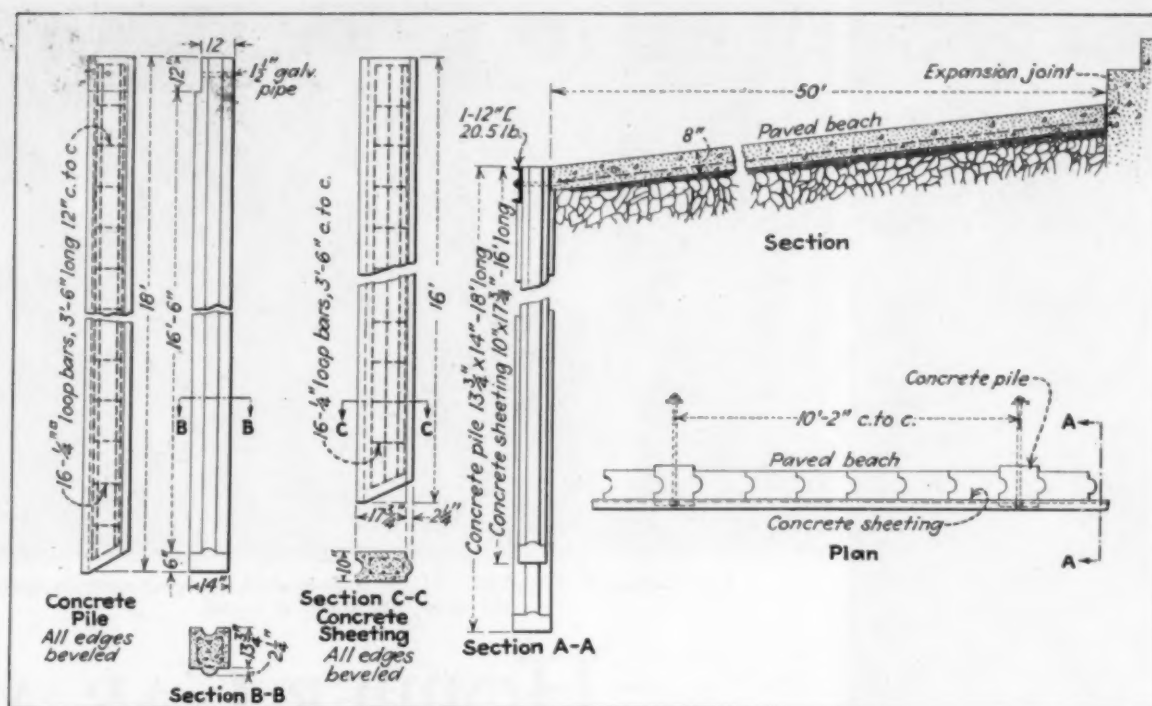
The accompanying sketches and photographs show details of the piling and the methods used in casting and driving them.



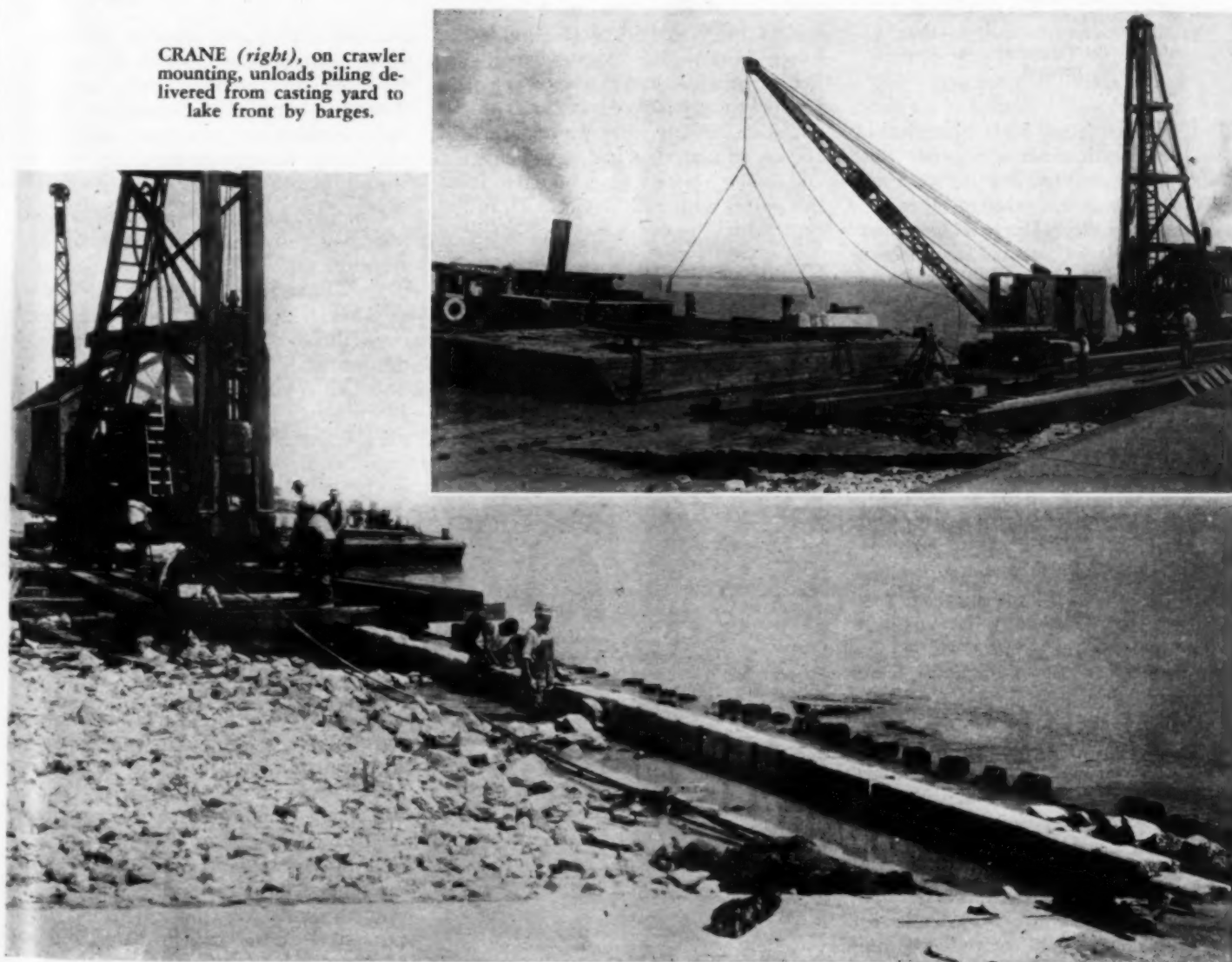
TONGUE - AND - GROOVE JOINTS (above) insure watertightness in completed sea wall of sheet piling. Hole in end of each pile facilitates handling.



METAL-LINED FORMS (left) are held together at top by strap clamp. Side forms are stripped after 24 hours.



CRANE (right), on crawler mounting, unloads piling delivered from casting yard to lake front by barges.





PNEUMATIC GUN at end of form in place in tunnel, with the gasoline locomotive used to shift platform car showing in foreground.

USING three 30-ft. lengths of full-section non-collapsible steel forms, erected 360 ft. apart and filled, stripped and shifted ahead in sequence, Boxley, Bray & Co., contractors on the Clinchfield connection of the Louisville & Nashville Railroad, have lined with concrete the 6,215-ft. single-track Hagan tunnel through the Cumberland Mountains between Kentucky and Virginia.

The methods used in driving this tunnel were described in *Construction Methods* for November, 1929. The section calls for a clear width of 16 ft. and a clear height of 24 ft. above the top of rail. The floor is paved with concrete, having a minimum thickness of 8 in. Along each side of the floor paving is a 12x6-in. concrete-lined open drain. Side walls have a minimum thickness of 1 ft. 6 in. in untimbered, and 2 ft. 6 in. in timbered sections. The arch is 2 ft. thick at the crown.

The tunnel was driven through rock, about half of which required timbering. In placing the concrete lining no dry packing was used; instead, the contractor placed enough concrete to fill the overbreakage. For concrete beyond the standard wall and arch dimensions, allowance was made for packing concrete at a reduced unit price.

One tunnel portal is adjacent to the



CONCRETING TUNNEL FLOOR in half-widths by chuting from hopper car filled from mixer at portal.

HOPPER CAR. AND *Place Concrete Lining in*

line of the Louisville & Nashville between Corbin, Ky., and Norton, Va. When the work started, the other portal was practically isolated so far as transportation of any kind was concerned. Hence, all materials had to be delivered and lining operations conducted from the portal with rail service. Here the contractors erected a material-handling

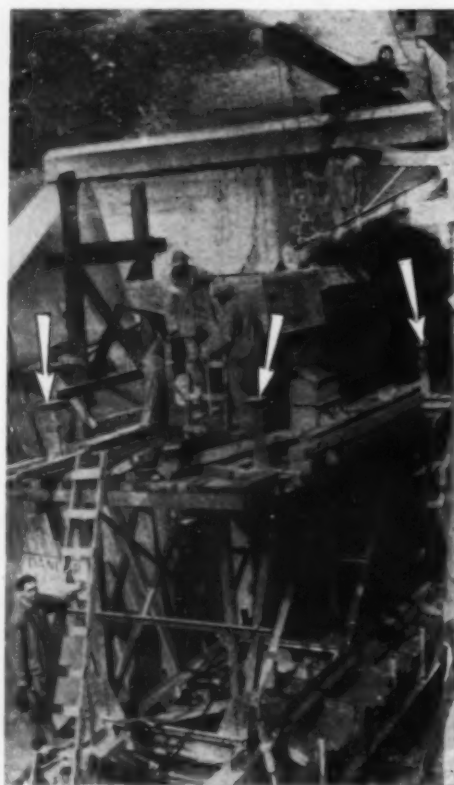
and concrete-mixing plant on the berm of a deep approach cut. Materials, delivered on a siding, were handled through stock piles to hoppers by clam-shell buckets on stationary derricks and thence by narrow-gage cars to the mixing plant.

Concrete Placing Equipment—Concrete was delivered from the mixer by a bottom-dump bucket operated on an inclined overhead trolley to a 6-yd. elevated hopper over the permanent track through the tunnel and close to the portal. Thence concrete was fed into two 3-yd. steel hoppers mounted 18 ft. above the base of the ties on a steel frame built up on a standard-gage flat car hauled by a gasoline locomotive.

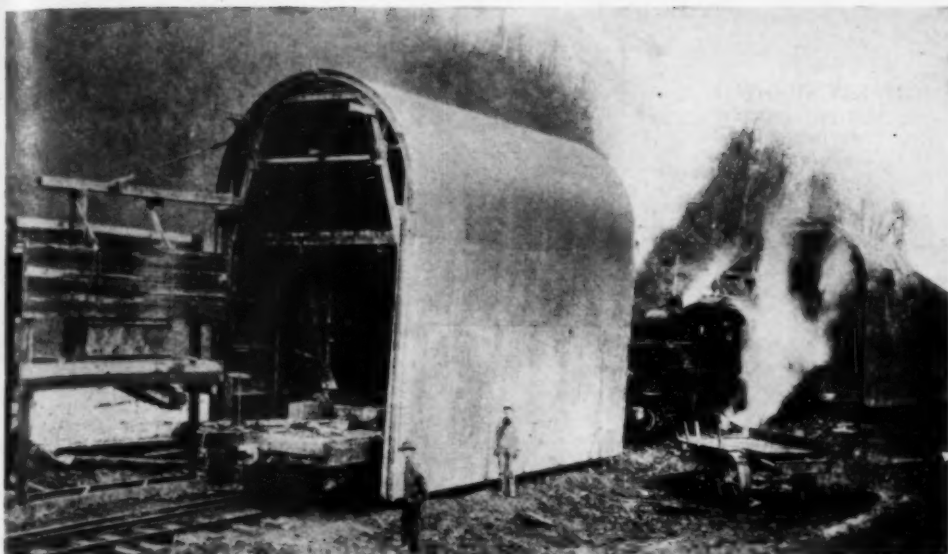
Attached at the far end of each of the 30-ft. sections of tunnel forms was a Ransome pneumatic placing gun of 14-cu.ft. capacity. Concrete was fed from the elevated car hoppers by gravity to the sidewall forms. The arch concrete was all placed by the guns.

Steel Forms—The Blaw-Knox steel forms employed differed both in general principles and in details of design from previous common practice. Each 30-ft. unit consisted of a smooth steel shell extending from the foot of one wall up over the arch and down to the foot of the other wall. These continuous shells were bolted to a structural-steel frame. Each 30-ft. length of form weighed 40 tons.

Lining Operations—The tunnel



PLATFORM CAR at portal, showing jacks used in raising and lowering 40-ton form sections.



STEEL FORM in 30-ft. section complete with frame for pneumatic gun and hopper.

PNEUMATIC GUN *L. & N. Railroad Tunnel*

floor was concreted in half widths in advance of the work on the walls and arch to provide a footing for the forms. Concrete was delivered in a 4-yd. steel hopper car on narrow-gage track. This hopper was set high enough to discharge by gravity through a chute with a 180-deg. swing. With this hopper-car working crab-fashion, the first strip of floor was laid for a convenient distance. Then the narrow-gage track on which the car operated was shifted to the finished slab and the other half of the floor completed. On the completed floor permanent track through the tunnel was laid on creosoted ties. The framework of the standard-gage platform car operating on this track then served as a traveler for handling the 40-ton form sections.

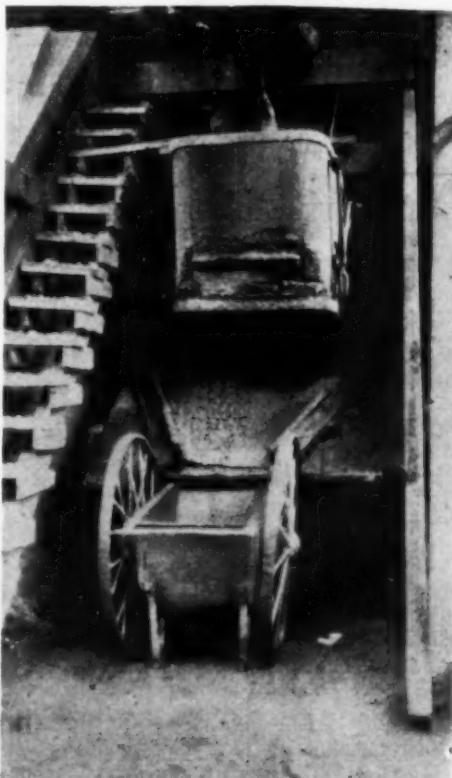
The vertical wall posts of the forms extended down only to within 2 ft. of the floor drain bottoms. The shell of the forms, however, was continued down to that level, with a vertical sliding joint the full length of the base on each side.

In setting a 40-ton form section, timbers of the right size were first placed lengthwise of the side drains. Hardwood wedges then were driven between these timbers and the feet of the vertical form posts. At the same time the wall posts were braced by struts wedged against the track ties.

Having set a section of form, the sidewalls were poured simultaneously from the two hoppers on the traveling platform car, thus balancing the thrust on the forms. Placing also was car-

ried from end to end of the form so the two walls rose at a uniform rate for the entire length of the section.

Pneumatic Gun — The pneumatic gun for each form unit and a 6-yd. hopper through which concrete was supplied to it were set in a space only



CONCRETE BUGGY under drip apron at mixer plant permits quick shift of bucket taking discharge from mixer without loss of concrete or messing up of plant.



REAR END OF FORM, showing wedges and struts used to shore the form in place.

2 ft. 3 in. wide at one side and in front of the section in order to give train clearance on the permanent tunnel track. This close limit of space was met by placing the gun and the hopper in a tall, narrow frame partly hung from the adjacent end of the form. When the form was being moved, however, the main weight of the gun and hopper was carried by pairs of large and small traveler wheels that ran respectively on the curb and in the bottom of the floor drain. When the form was set in place, this frame was shored up on wedges to give it ample stability.

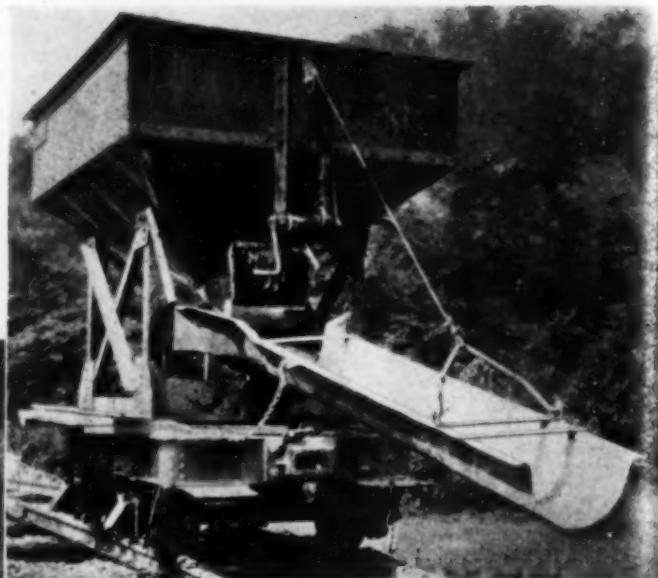
The concrete guns were supplied with air from a large general service compressor plant near the portal. Each gun had a 6-in. discharge leading to the forms. Steel pipe with the bends made on the job was used for this discharge, with the exception that a short section of rubber hose carried the last shots in closing the arch.

Sequence of Concreting—While the platform car carrying the two concrete-handling hoppers was being shifted from the mixer to the forms, the mixer output was delivered to the 6-yd. elevated hopper at the portal. When the platform car returned, the two 3-yd. hoppers on it were quickly filled by gravity from the elevated hopper. The specifications prohibited the placing of concrete that had stood 30 min. or more, but no difficulty was

experienced in meeting this requirement.

After the sidewalls of a section of form had been filled, concrete was fed by gravity into the 6-yd. hopper from which the concrete placing gun was supplied. This arrangement permitted the gun to be run practically continuously while the platform car returned to the mixing plant for another load.

HOPPER CAR (right) for placing concrete floor paving. **AIR HOIST (below)** handles inclined trolley used to move concrete from mixer to elevated hopper at the portal.



Two men stationed in the space between the arch form shell and the timbering of the excavation handled the 6-in. pipe through which the concrete was discharged to place. This pipe inside the form was in 5-ft. sections which were successively removed

as the arch concrete approached the end of the form section.

Closures in the lining usually were made every 360 ft., which allowed for twelve shifts of a form section.

Shifting Forms—When a section of form was to be shifted, the platform car was run under it and the form picked up by four hydraulic jacks. The sides of the form were then drawn inward by pairs of ratchet jacks to provide clearance for the form when moved ahead to its next setup.

In resetting the form its end was left about 6 in. inside the finished concrete of the last section of lining. The forward and free end of the section was lined in position by a pair of jacks set on brackets cantilevered out from the posts of the form frame.

Progress—A foreman with three men on the platform car, three at the concrete gun and two in the form, place from 200 to 220 cu.yd. of concrete required to fill a section of form as a continuous shift assignment. They usually finish in from 8 to 9 hours. The form gang consists of 6 men, who can strip, move, clean and oil a section of form ready for concrete in 6 to 8 hours.

In July 5,500 cu.yd., and in August 6,350 cu.yd., of concrete lining was placed. For the seven months that the forms were in use up to the end of August, the monthly average was about 500 ft. of finished lining. This included the time required in breaking

in the crew and in working out a scheme of operations. As the crew became more experienced, the records improved fast, as shown by the fact that 630 lin.ft. of lining was placed in July and 753 ft. in August. J. B. Bray, resident partner in charge for the contractors, is of the opinion that this type of form will show good results for large-section tunnels more than 3,000 ft. in length.

Personnel—W. H. Courtenay is chief engineer and G. R. Smiley is chief engineer of construction for the Louisville & Nashville Railroad, with J. B. Cochran in charge of the project as resident engineer.



DOUBLE GATE on chute leading from 6-yd. hopper takes the last dribble of concrete and permits the platform car to get away quickly.



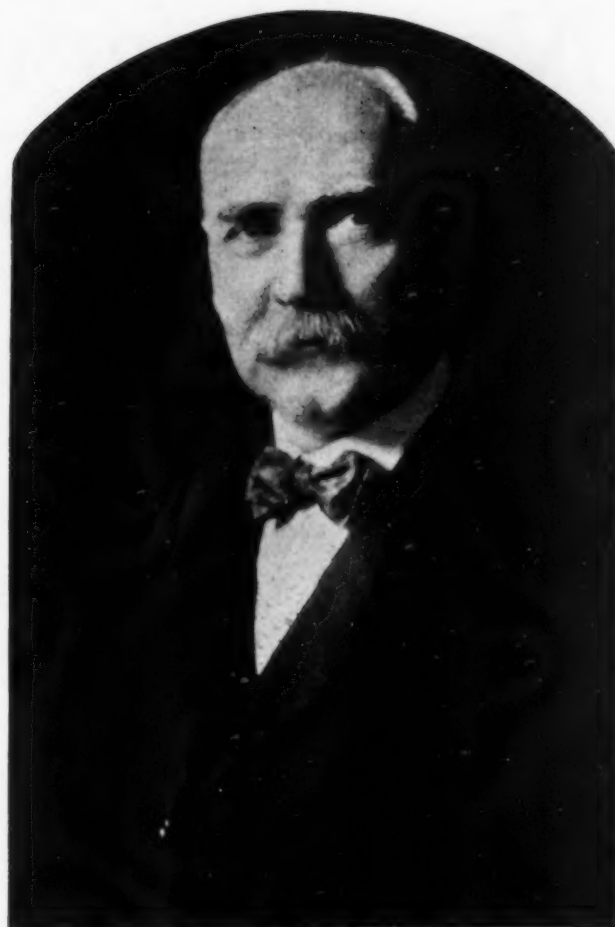
COMPLETED SECTION of tunnel lining with 30-ft. section of steel forms moved forward for next pour.

Present and Accounted For —

A Page of Personalities



CONTRACTORS' NEW PRESIDENT. Albert P. Greensfelder, president of the Fruin-Colnon Contracting Co., of St. Louis, Mo., was elected to head the Associated General Contractors of America at its annual convention in San Francisco last month. As officer and committee member he has for years been active in the association's affairs.



HEADS CIVIL ENGINEERS. Francis Lee Stuart, consulting engineer of New York, was elected last month to the presidency of the American Society of Civil Engineers. He was formerly chief engineer of the Baltimore & Ohio Railroad and of the Erie Railroad and before that served as division engineer on the Isthmian Canal Commission.



CONSULTING ENGINEERS FOR GOLDEN GATE BRIDGE discuss plans for \$35,000,000 suspension structure with main span of 4,200 ft. at San Francisco. (Left to right) A. H. Ammann, chief engineer, N. Y. Port Authority; Charles Derleth, Jr., dean of engineering Univ. of Calif.; Prof. Andrew Lawson, consulting geologist; Joseph B. Strauss, chief engineer, Golden Gate bridge; Leon F. Moiseiff, consulting engineer.



COLORADO'S HIGHWAY ENGINEER. Charles D. Vail, formerly manager of parks and improvements at Denver, has been appointed state highway engineer of Colorado to fill the vacancy caused by the death of Louis D. Blauvelt.

NEW EQUIPMENT ON THE JOB

Weigh Hopper for Bucket Loader

A feature of the new crawler-mounted bucket loaders manufactured by the Barber-Greene Co., of Aurora, Ill., is a weigh hopper provided with an American Kron scale, which will



weigh batches up to 3,600 lb., not exceeding 32 cu.ft. in volume. The dial on the scale is graduated into 2-lb. units and is provided with two markers which may be set to indicate the desired reading.

The new loader is equipped with an overload release sprocket on the crawler drive for protection of this mechanism. The capacity of the loader is 62 cu.ft. per minute.

Two-Speed Excavator Hoist

A new two-speed slackline excavator hoist has been added to its line by Street Bros. Machine Works of Chattanooga, Tenn. The main parts of the frame which support the drum hous-



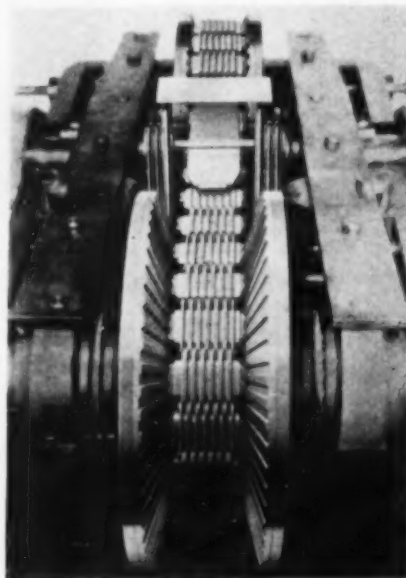
ing, drums, and power plant are made of extra heavy I-beams with the upper flange reinforced and planed to form a true seat for the drum housing. Special care was taken to make the base rigid in order to keep the working parts in strict alignment under constant vibration.

The drums are made in three pieces—a barrel and two flanges—which may be replaced at nominal cost. Gears are

of steel with wide base, coarse pitch and cut teeth. Pinions are of forged steel with machine-cut teeth.

All-Metal Variable-Speed Transmission

An all-metal variable-speed transmission, known as the P. I. V. Gear, has recently been placed on the market by the Link-Belt Co., Philadelphia. This new speed change unit consists of two pairs of wheels of the opposed conical disk type, between which a special chain transmits power. The effective diameters of each pair of wheels can be altered under load to



change the speed ratio, without steps and without dependence on friction. On changing speed, the self-pitching chain rises in one set of wheels and descends in the other, so that while the input shaft connected to a motor or other source of power turns at constant speed, the output shaft is brought to the desired r.p.m.

The gear may be obtained in five sizes, from 1- to 10-hp. capacity, providing speed change ratios up to the maximum of 6:1.

For Better Mortar Joints

Brikron, a new product of the Master Builders Co., Cleveland, is an admixture to prevent efflorescence, leakage, crazing, cracking and spalling of masonry mortar joints. Its ingredients arrest the formation of soluble salts and prevent moisture seepage.

Combination "Dirtmover" and Tamping Roller

For use in building embankments and making fills, the American Tractor Equipment Co., of Oakland, Calif., is marketing a tamping roller which may



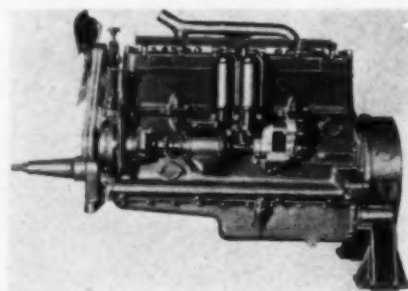
be used independently or in combination with the "Ateco" Dirtmover, as shown in the photograph.

The roller consists of two hollow, water-tight cylinders, each 48 in. in width, to which are welded 112 ball foot castings. The normal weight of the unit, 5,485 lb., provides 665 lb. of pressure. For additional weight, the cylinders may be filled with water, thus providing 8,800 lb. or 1,080 lb. of pressure per foot.

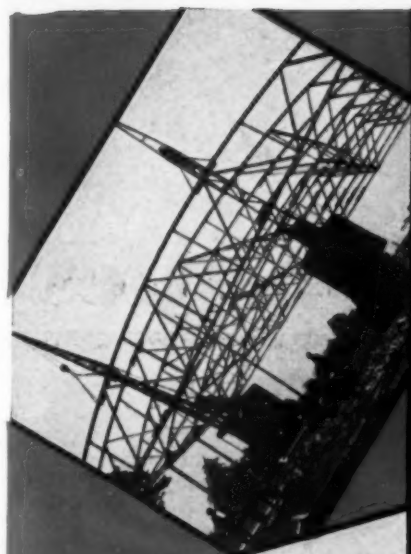
In operation the Dirtmover loads, hauls and spreads materials and the tamping roller tamps the fills in one operation.

Heavy-Duty Engines in Five Sizes

An additional line of heavy-duty six-cylinder gasoline engines of the L-head type is offered by the Hercules Motors Corp., of Canton, Ohio. This series, known as the HX, is produced in five sizes, identical in design and with piston displacements ranging from 638 to 935 cu.in. The crankcase, of either



aluminum or gray iron, is cast separately from the cylinders. Connecting-rod bolts are forged integrally with the rod, assuring great strength. Cylinders are cast in groups of three. Lubrication is by a gear-driven oil pump. Special attention has been given to cooling, particularly of the valves. At 1,600 r.p.m., the maximum speed for continuous service under peak load, the engines of this series develop from 118 to 175 hp.



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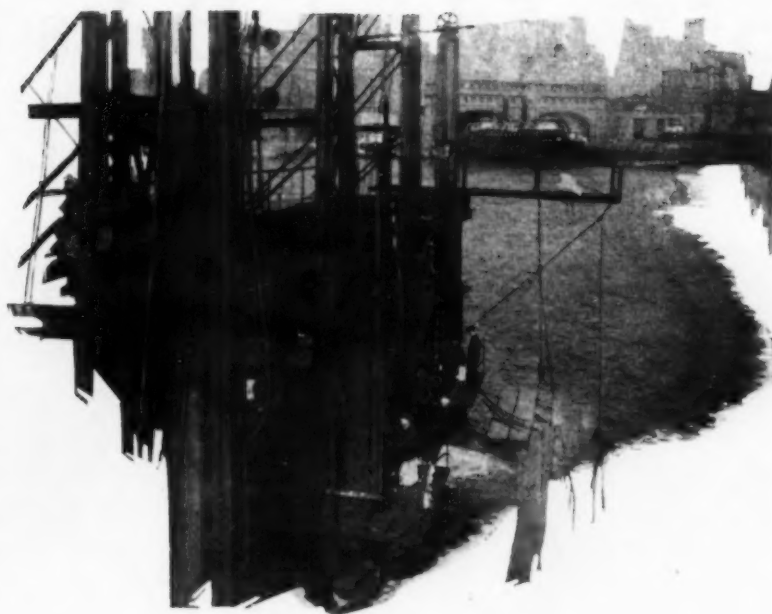
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Drilling the bottom of New York Bay

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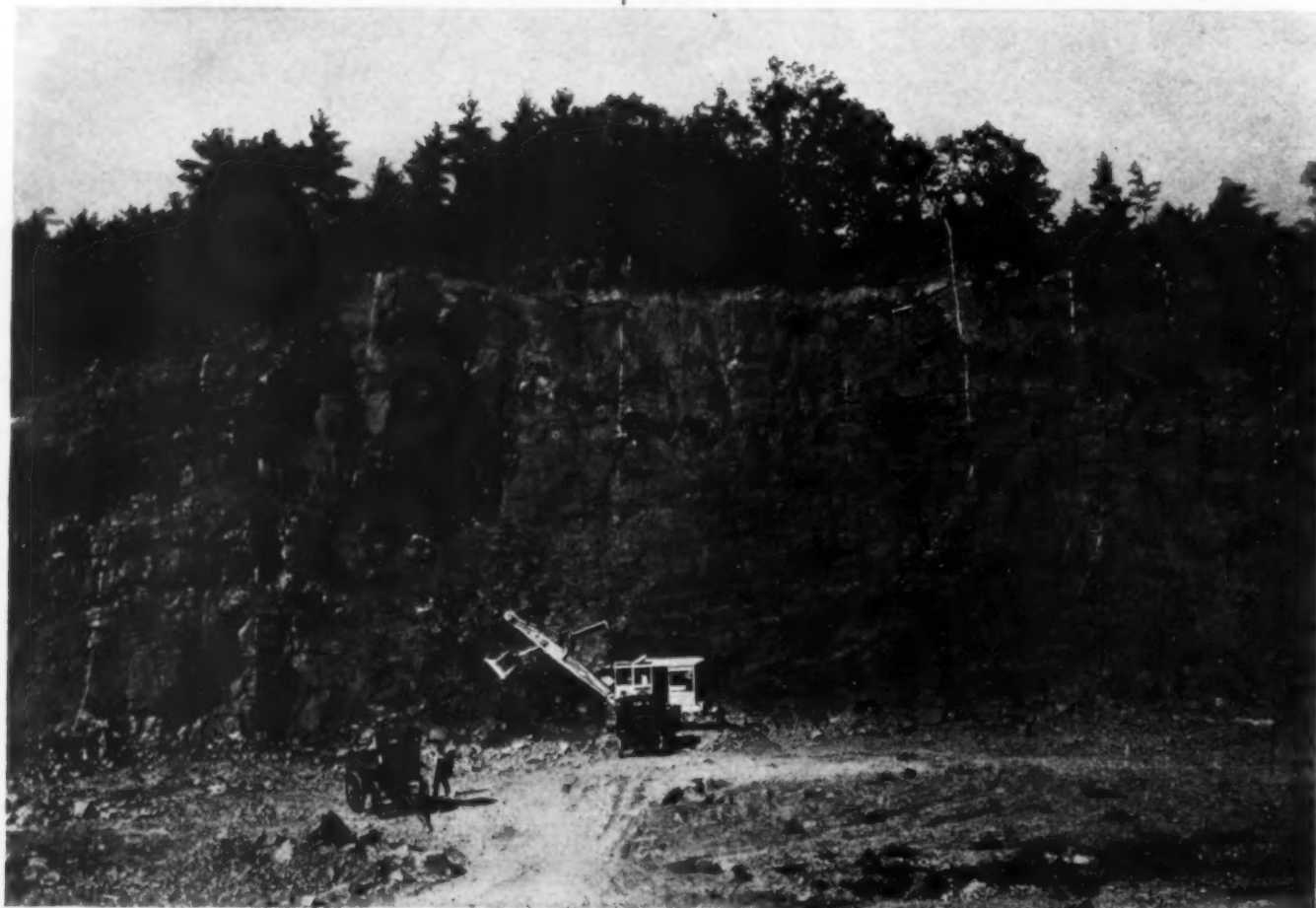
New Process

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IT IS a significant fact that so large a proportion of orders for Link-Belt Shovels—Cranes—Draglines is repeat business. And also probably just as significant is the fact that amongst those users are listed some of the most prominent and largest concerns in the country—Ford, Anaconda, U. S. Steel, General Electric, Standard Oil, Swift & Co., and other industrial leaders. This is the best proof we can offer of the good-all-the-way-through quality of the Link-Belt Shovel—Crane—Dragline.

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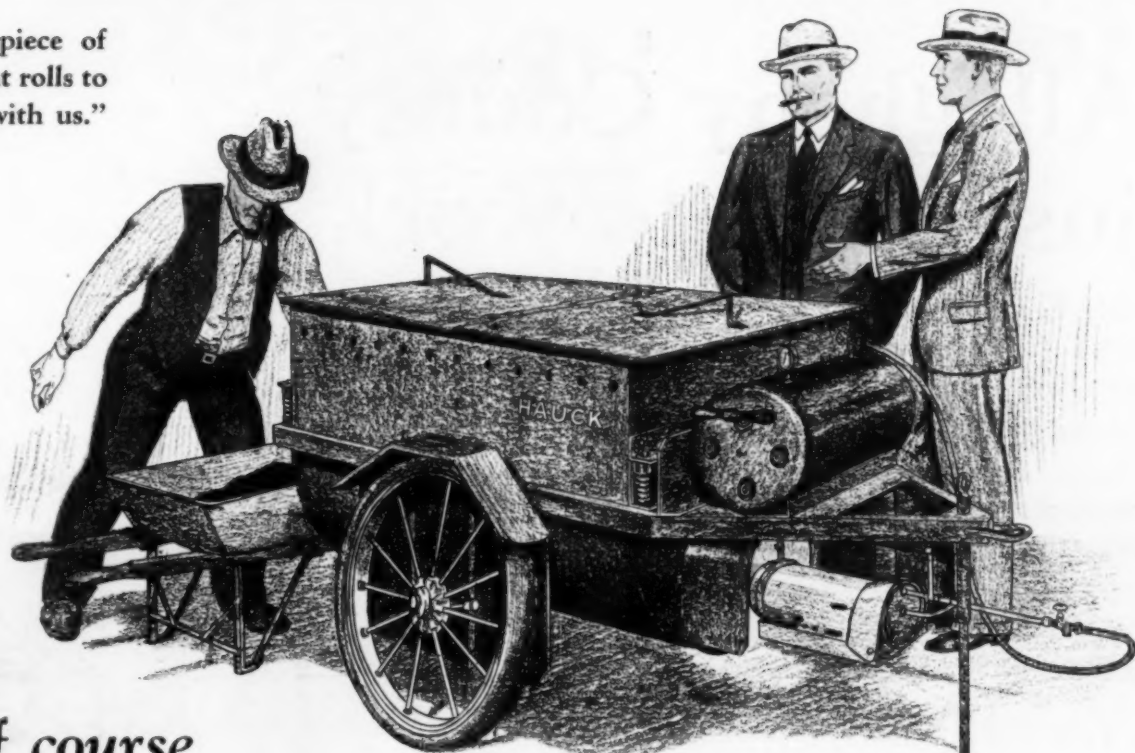
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	Brush-Burning Torches
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Hauck Tool Heater

Heats tampers and smoothers; heats binder cement; three burners; fast and economical.

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for patching—saves time, labor, material, fuel.



YOUR gang won't have to wait for hot joint-filler or patching cement with a Hauck Oil-Burning Kettle on the job! For a Hauck heats up *fast*. Takes much less time than coal—half the time of wood. And the powerful Hauck burner gets up full heat in five minutes, starting cold.

Saves fuel cost, too. You get full value from kerosene, coal oil or light furnace oil—without waste. No labor, no stoking, no waiting. No long delay while "firing up." No smoke or spark nuisance. No overheating or "coking" the asphalt—the simple, fool-proof "Slide-Rail" Heat Control gives instant adjustment without turning a valve. Only Hauck kettles have this advantage.

Burner and fuel tank are detachable. Just loosen two straps and you have a portable torch for odd heating jobs anywhere. Saves its cost on maintenance or on new construction. Use one Hauck for every mixer outfit; it's handy.

Investigate now—be ready to bid low without loss on the jobs you intend to get this year. Write for facts on Hauck performance—detailed dimensions, capacities, prices—Bulletin 652, sent free.

HAUCK MANUFACTURING COMPANY

101-111 Eleventh Street

Brooklyn, N. Y.

Branch Offices and Warehouses, Chicago and San Francisco

HAUCK

OIL BURNING CONSTRUCTION EQUIPMENT

Allegheny County just put 2 to work

Allegheny County, Pa., recently purchased two BAY CITY Model-R $\frac{3}{4}$ -yd. Shovels. This one is shown at work in South Park, Pittsburgh.

Model-R is a 26-ton, full revolving, convertible shovel, crane dragline, ditcher, skimmer, clamshell or backfiller. Light enough to move easily—heavy enough to stand up under continuous service.

The distance from boom base to center of rotation is only 30 inches—about half the usual distance on full revolving shovels. This increases the stability more than any other single factor—and it's a BAY CITY feature.

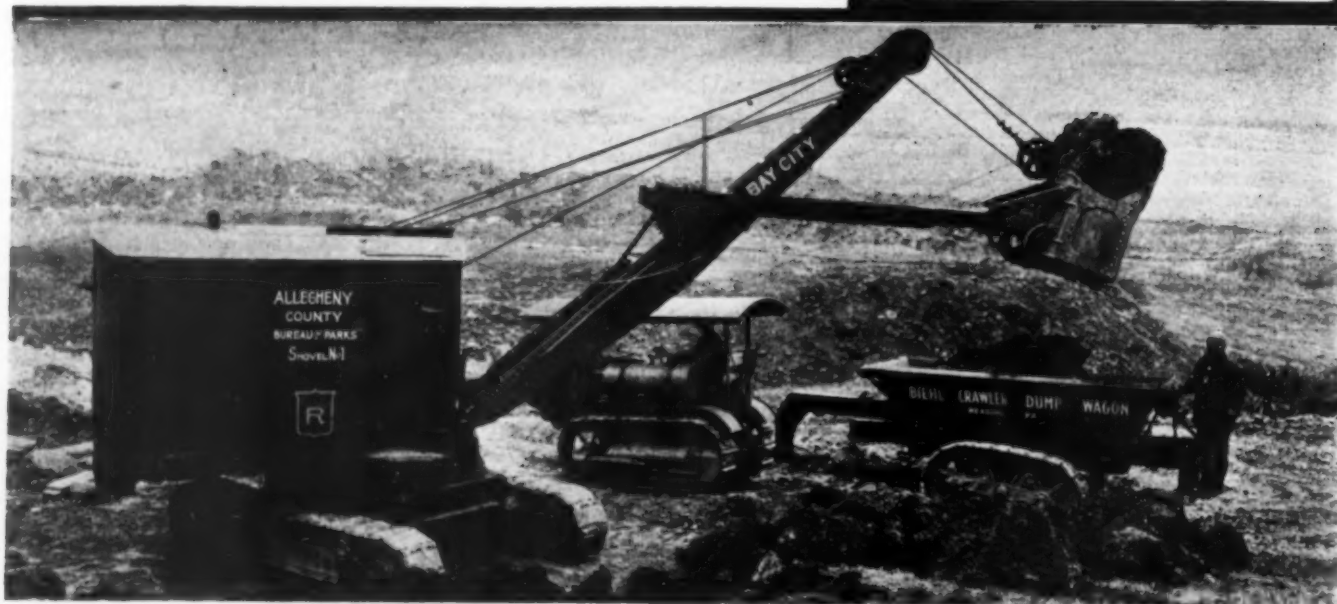
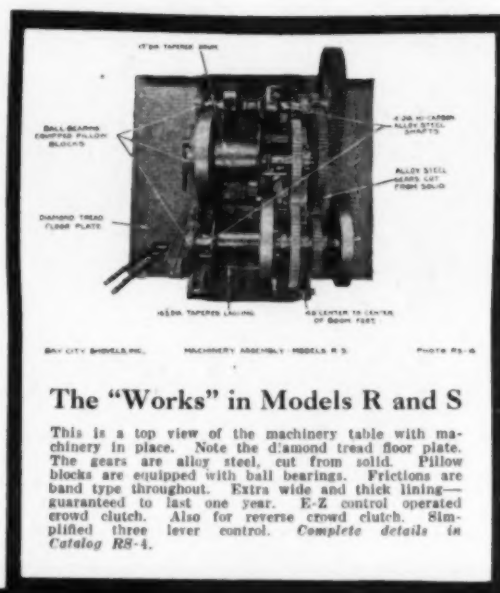
BAY CITY builds a machine for every job—from $\frac{3}{8}$ yd. to full size 1 yd.

*Catalog RS-4 describes Model-R ¾ yd. and Model-S 1 yd.
You will find it most interesting.*

BAY CITY SHOVELS, Inc.

New York Office—302 Broadway

BAY CITY, MICH.



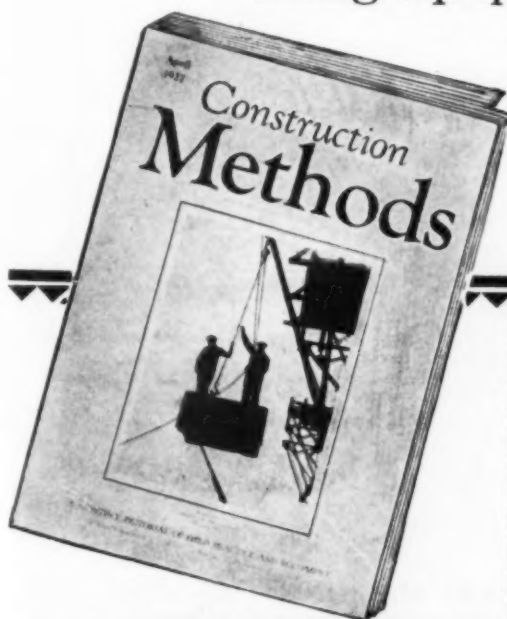
BAY-CITY SHOVELS

THE BAY-CITY FAMILY OF FAST WORKERS



Are You Interested In!

Saving time and money on the job?
 New Construction ideas?
 More profit from each contract?
 Speeding up Construction?
 Using equipment to better advantage?



*You will find the answers to these questions
 each month by subscribing to your own
 copy of Construction Methods.*

Fill Out This Coupon—NOW

CONSTRUCTION METHODS, Tenth Ave. at 36th St., New York, N. Y.

All Right. Here's my money for my own subscription to Construction
 Methods. One Year (12 issues) \$1.00

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Nature of Business..... Title.....

CM-Ad-6

Please Fill In Every Line

DIETZ LANTERNS



FOR UNFAILING LIGHT

USE
RED
NO
OTHER
COLOR
MEANS
DANGER

THE unfailing light of Dietz Lanterns has its origin in correct design and scientific control of combustion.

Contractors who use Dietz Lanterns for night warning duty on construction work not only fulfill the law's requirements but assure genuine protection to traffic, with freedom from accidents, possible damages and self reproach.

No other warning signals equal red globed Dietz Lanterns in protective surety and low cost.

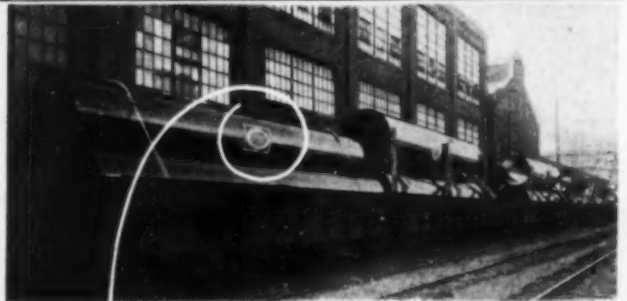
R. E. DIETZ COMPANY
NEW YORK

Largest Makers of Lanterns in the World
FOUNDED 1840



IT
PAYS
TO
BUY
GOOD
LANTERNS

THE SERVICE THAT STARTS IN BIGGS' PLANT



SHOWS ITSELF MOST CLEARLY IN YOUR DITCH

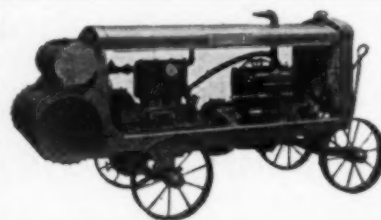


Above is a typical day's production of Biggs electrically welded steel pipe in connection with three major water works projects involving 50,000 feet of 30 in., 48 in., and 72 in. welded pipe.

BIGGS Electrically Welded Steel Pipe comes to you exactly as you want it. Actual acquaintance with field conditions you will encounter enables Biggs service to save time and money in your construction costs. Joints come at convenient points. Specials are on hand when needed. The pipe fits accurately. Testing goes off without a hitch. Consult with Biggs on the next pipe line in your territory.



The Biggs Boiler Works Co., Akron Ohio.



Air Power 75 foot Underwater Cuts Piles in 3 Minutes

Vancouver smashed hand saw records, by cutting 1000 piles from the bottom of the harbor with air power. Piles were 14 to 18 inches thick, and set in water 40 to 75 feet deep.

Two divers did the cutting with an air saw, using air at 100 lbs., from a Sullivan Vibrationless Compressor. Only 3 minutes were needed to saw through a pile, and start it on its way to the surface.

This profit-making application of air is one of hundreds, on which Sullivan Air Equipment is at work. Many ideas are pictured and described in Sullivan booklets, free on request. Ask for "Speed Up With Air."

SULLIVAN AIR EQUIPMENT

SULLIVAN MACHINERY COMPANY
816 WRIGLEY BUILDING, CHICAGO



4" Self- Priming Homelite Portable Centrifugal Pump



HOMELITE CORPORATION
75 Riverdale Avenue, Port Chester, N. Y.

HOMELITE
4" and 2" Portable Self-Priming
Centrifugal Pumps

Also Portable Blowers, Air Compressors, Electric Generators—all powered by Homelite Air-Cooled Engines

Homelite Facts that get home

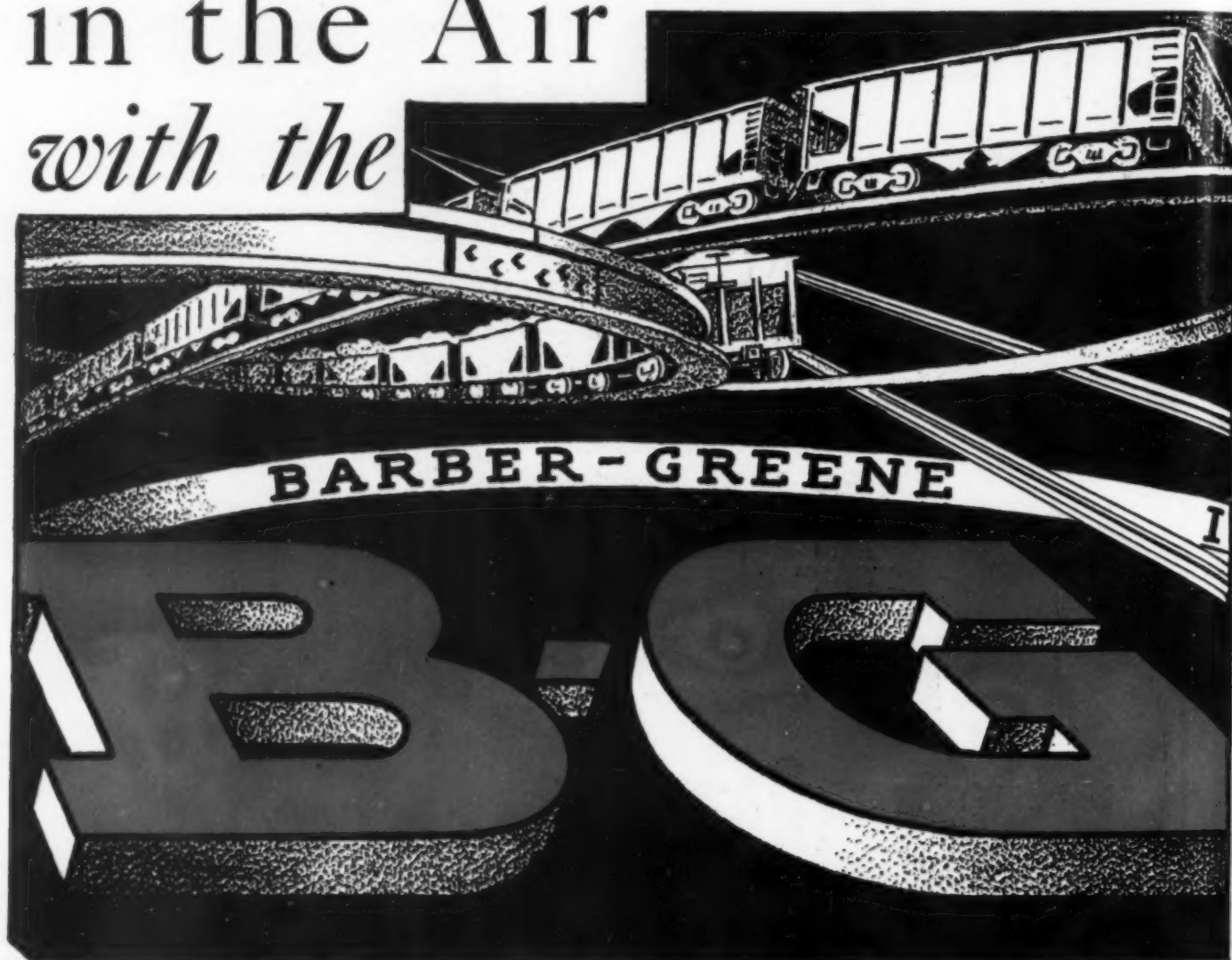
Self Priming—no foot valve. No vacuum auxiliaries of any kind. Capacity 25,000 gal. per hr. Suction lift 20 feet. Powered by LeRoi 8-10 H. P., 4 cylinder gasoline engine. Bronze open type impeller. Handle telescopes into frame when not in use. Weighs 730 lbs.

\$480

F. O. B. Port Chester, N. Y.

⊕ 4022

Magic Switch Tracks in the Air *with the*



A New Material Moving Principle — the Stream that Almost Flows by Itself

The *B-G Idea* magically extends switch-tracks through the air, to where you want materials and aggregates to be poured. Gondola loads literally flow to where they should go.

For the new *B-G Idea* of material move-

ment creates the stream that almost flows by itself.

A swiftly moving belt or continuous bucket line is the only basic moving machinery. Practically nothing moves—but the fast flowing material stream.

Yet the entire principle is so simple that the finest engineering and construction can be used throughout—at very low prices.

BARBER

530 West Park Avenue





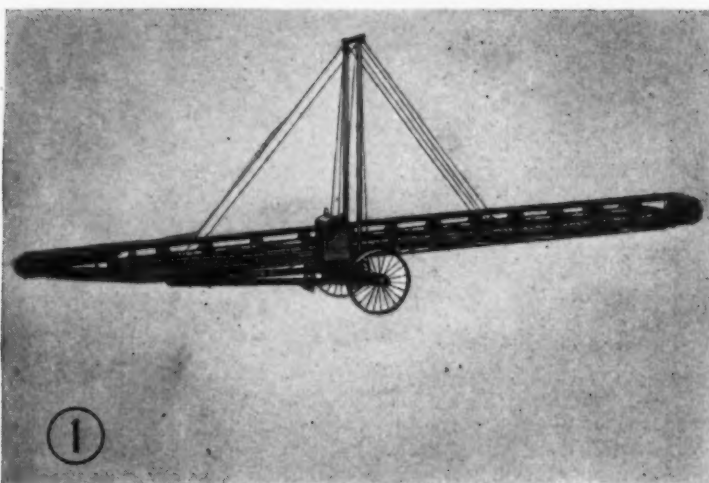
And constant application of the Barber-Greene Idea has developed a long line of machines that unload cars, and handle a wide variety of other material moving jobs, both extremely big and little.

Check that line today, in the interests of your own material problems. You will find answers that may surprise you in their speed and low cost simplicity. Ask for the Barber-Greene Line Book.

GREENE

Aurora, Illinois

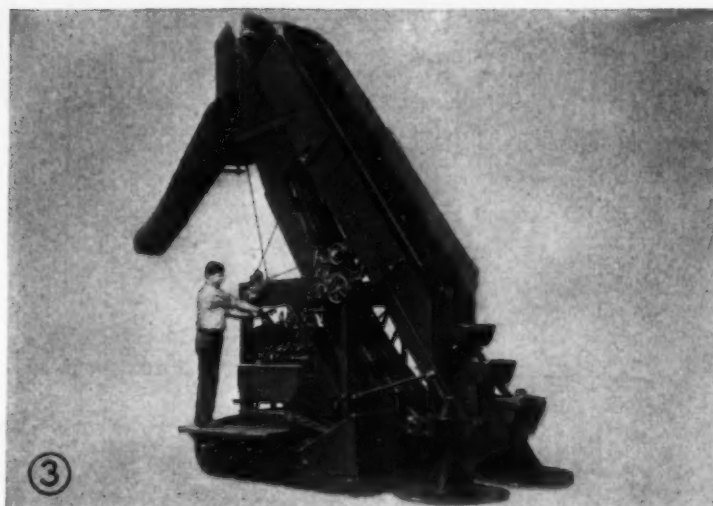
CONSTRUCTION METHODS—February, 1931



Barber-Greene Portable for handling wet concrete or any bulk materials.



Barber-Greene Portable and Belt Car Unloader unloads aggregates from hopper cars.



The New Barber-Greene Model "62" Loader—62 cu. ft. per minute. Can be had with weigh hopper or high frequency vibrating screen.

Standardized Belt Conveyors	Portable Belt Conveyors
Portable and Self-propelled Flight Conveyors	
Self-propelled, Self-feeding Bucket Loaders	
Flight and Belt Car Unloaders	Snow Loaders
Vertical Boom Ditchers	



TRADITION



PROGRESS

"**B**UILDINGS Going Up By Arc Welding' says a headline in my paper and they talk of a couple going up in the West and a couple in the East.

I'm beginning to wonder, Lad, how much there really is to this welding of buildings."



Write for a complete set of "Studies in Structural Arc Welding"

"Not nearly as much to it as in riveted construction, Pop.

Let me take that pencil and make a drawing for you comparing the design of a riveted beam seat and a welded one.

Both are designed for a load of 45,000 pounds.

The riveted seat requires 2 angle members and a filler plate, and to fabricate it you punch 4 pieces and drive 8 rivets.

The welded seat requires but one member . . . a piece of a T shape.

You fuse this into the column with 18 lineal inches of $\frac{3}{8}$ " fillet weld.

So there's not as much in the arc-welded seat by 2 members and by a lot of labor.

I got that from Lincoln's "Studies in Structural Arc Welding" which is a series of plates for architects, engineers and fabricators . . . mailed without charge to those with welding work under way, as well as those 'way under-worked in welding."

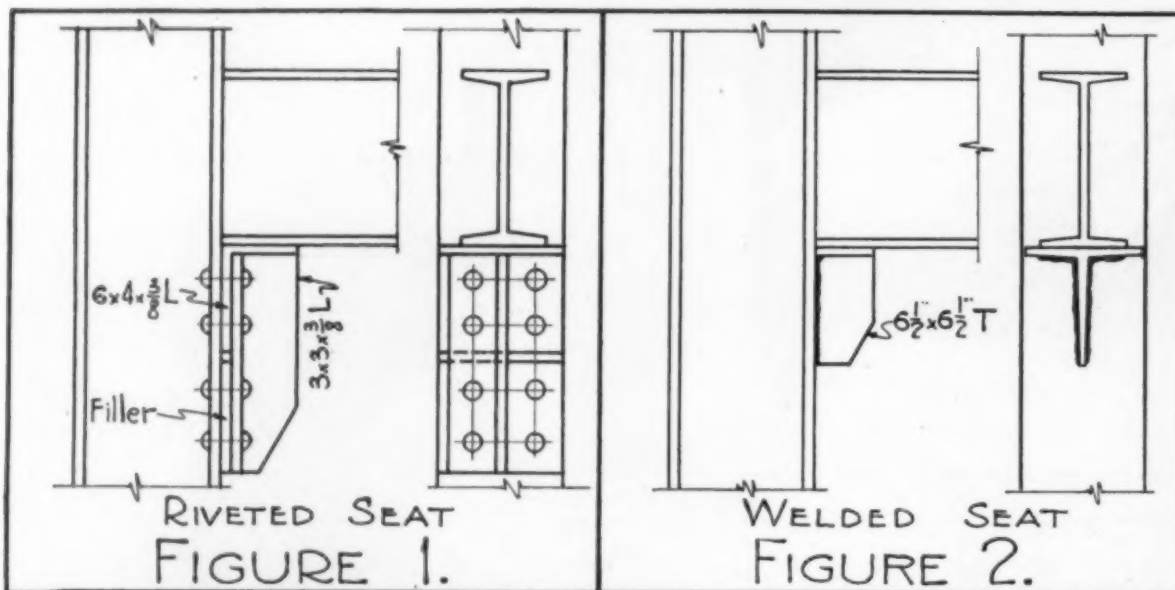
THE LINCOLN ELECTRIC COMPANY

Department No. 32-3

Cleveland, Ohio

World's Largest Manufacturers of Arc Welding Equipment

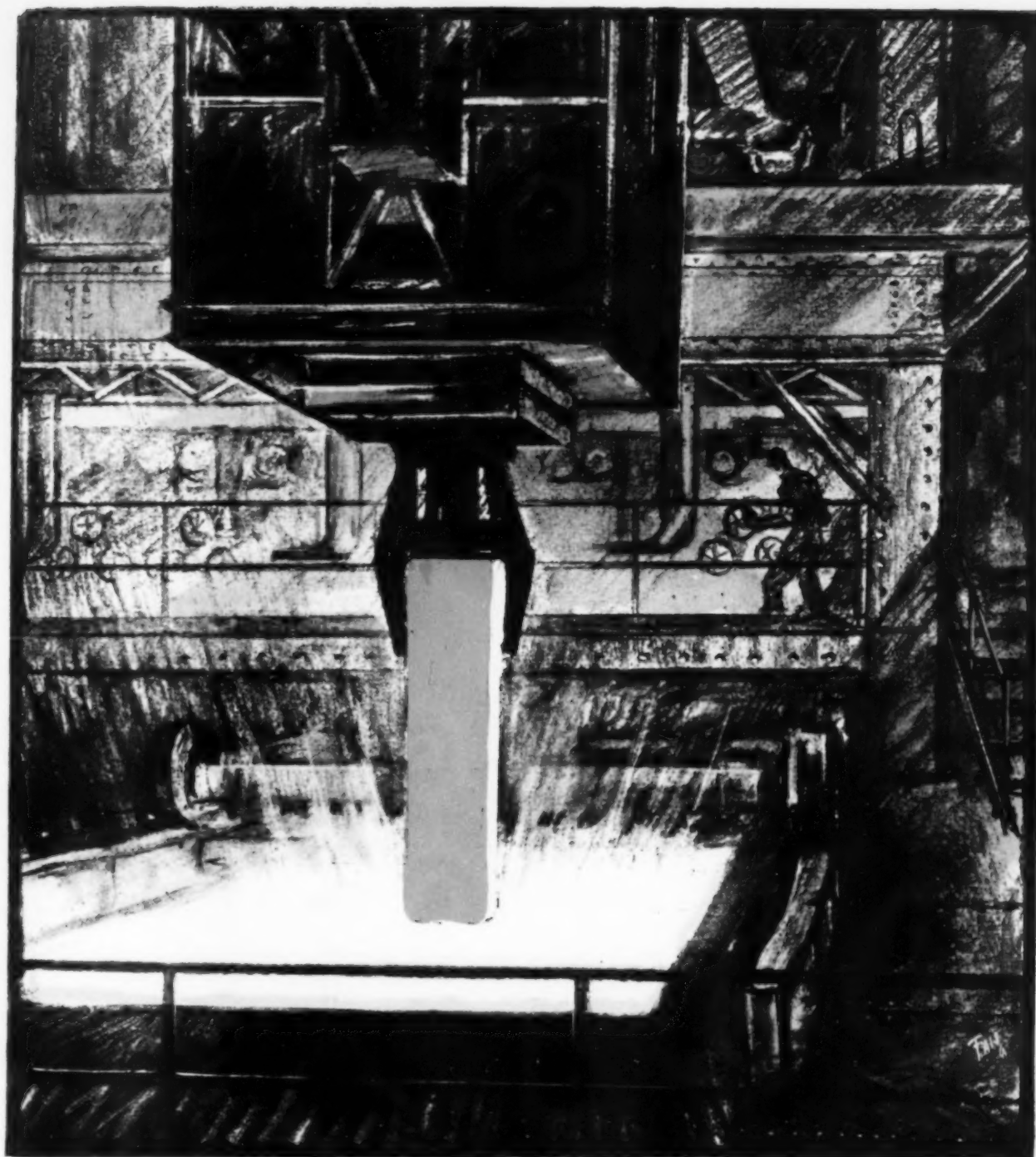
W-160



LINCOLN "Stable-Arc" WELDER

Lincoln "Stable-Arc" welder, motor-driven portable truck type, for use where electric power is available.





Down, down . . . into the Soaking Pit

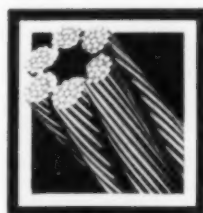
A RED INGOT of acid steel from the open-hearth mill. Now it is going into the soaking pit to insure thorough, uniform heating throughout. Then, sparkling white—on through to the blooming mill.

Seemingly endless are the operations in the making of Roebling Wire Rope. Each calls for a highly specialized skill and experience. Fine crafts-

manship prevails throughout the entire range.

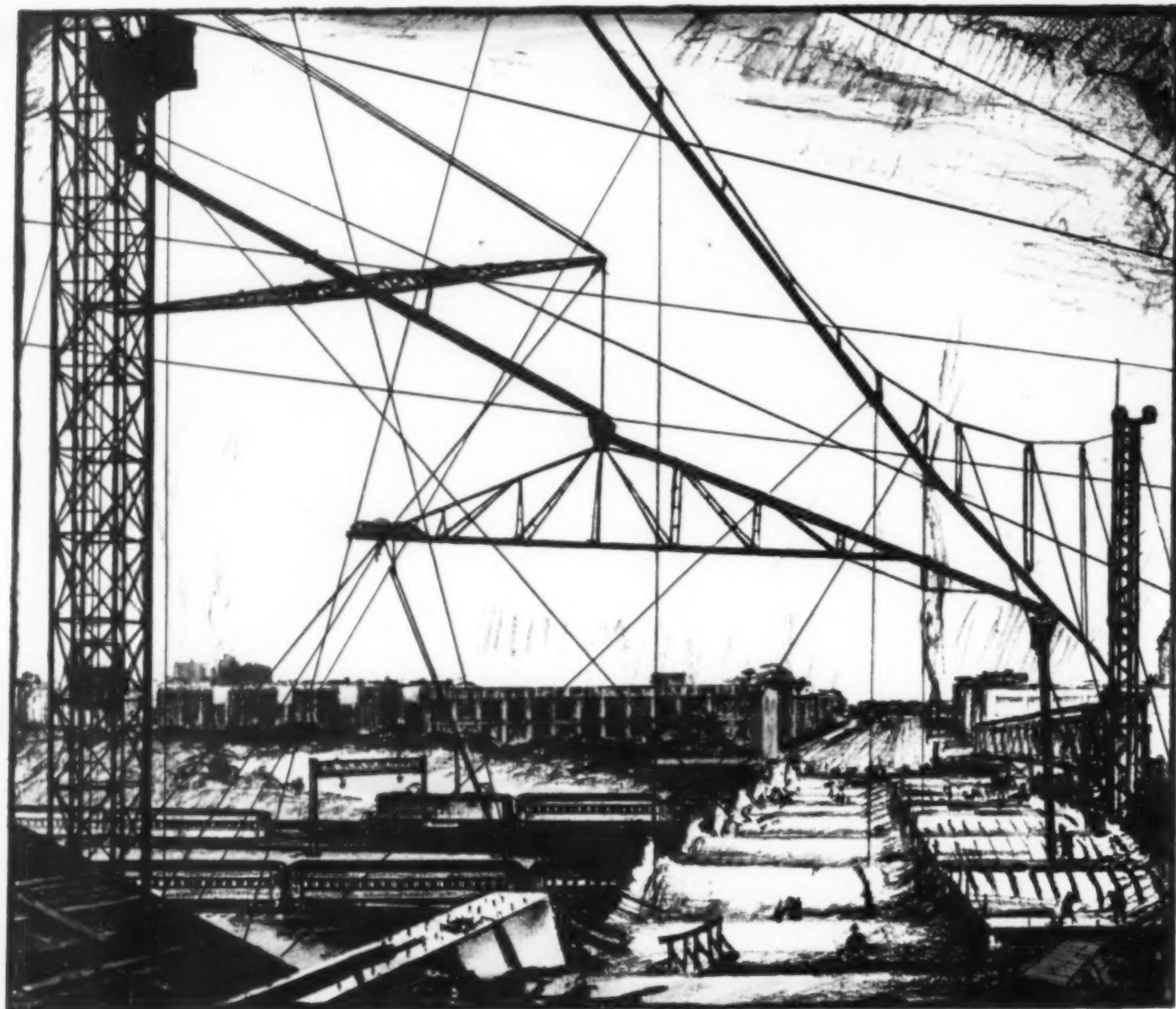
At Roebling the most modern of manufacturing methods and machinery are daily producing thousands of feet of Roebling "Blue Center" Steel Wire Rope. But tradition plays a part, too. It is old-fashioned thoroughness that guards that extra measure of service for which Roebling Rope is noted throughout industry.

ROEBLING



"BLUE CENTER"
STEEL

WIRE ROPE



Roebling-equipped *for safety*

THE CONTRACTOR on this bridge job could take no chances in rigging the concrete tower and chutes shown.

For the bridge, recently opened to traffic at 238th Street, Bronx, New York, spans eight railroad tracks of the New York Central, and New York, New Haven and Hartford Railroads, in addition to the Bronx River and two roadways of the Bronx River Parkway.

Obviously, every precaution had to be

taken to prevent the falling of equipment or materials to the tracks below. No chance of a railroad accident or of interference with train schedules could be tolerated.

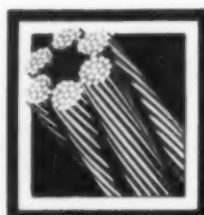
In rigging the concrete tower and chutes, naturally the finest wire rope obtainable was sought. Roebling "Blue Center" was the choice.

JOHN A. ROEBLING'S SONS COMPANY

WIRE...WIRE ROPE...WELDING WIRE...FLAT WIRE
COPPER and INSULATED WIRES AND CABLES
WIRE CLOTH and WIRE NETTING

TRENTON, N.J. Branches in Principal Cities

ROEBLING



"BLUE CENTER"
STEEL

WIRE ROPE

A SMOOTH "BOTTOM" ON YOUR "ROUGH" GRADING



Note how Baker Maney Scrapers used on this high-way job left the grade smooth in the usual course of "rough" grading.

BAKER MANEY Self Loading Scrapers

"The original Self Loaders"

1½ cu. yd.—1 cu. yd.—¾ cu. yd.

Timken Roller Bearings used on
1½ cu. yd. and 1 cu. yd. Scrapers



Baker Maney Scraper used in
correcting fine grade on a high-
way paving job.

Bulldozers? Backfillers?

That grading or filling job demands a Bulldozer or Backfiller with strength enough to push the heaviest material and flexibility to operate under varying conditions.

Baker Hydraulic Bulldozers and Backfillers have the strength to do the toughest jobs. They have a wide range of lift—high enough to clear large stones or stumps and can be adjusted to cut 6 to 10 inches below the ground level. This floating blade feature any contractor will appreciate.

Baker Hydraulic Bulldozers and Backfillers are made for "Caterpillar" and "Monarch" Tractors. Hand-operated models for many light industrial tractors.

BAKER BULLDOZERS BACKFILLERS



Baker Maney cut close to the grade stakes. Instead of leaving an uneven grade, you get a smooth "bottom" with very little finishing to do. This feature, due to the positive control of the pan cutting edge, is saving money for Contractors and Road Officials.

Baker Maney are successfully used in correcting fine grade between forms on paving jobs, carrying the surplus dirt and depositing it where needed.

This is the only one of the many features Baker Maney possess such as short turning radius—four wheeled construction—Timken Bearings—compacting action—low center of gravity—rugged construction—easy operation—low operating and up-keep costs.

Investigate the original self-loading Scrapers and learn why they lead the way to simpler and cheaper earth-moving methods.

Write for Baker Maney Catalogue
Or Use Coupon Below

The Baker Manufacturing Company
567 Stanford Ave., Springfield, Ill.

BAKER

**TRACTOR
EQUIPMENT**

EARTH MOVING—ROAD MAINTENANCE—SNOW REMOVAL

Please send literature on
Baker Equipment

- Baker Maney Scrapers ☐
Bulldozers ☐
Backfillers ☐
Rotary Scrapers ☐

Name

Address

567



COMMERCIAL EQUIPMENT CORPORATION

Commercial Equipment Corporation, affiliation of Commercial Credit Companies, provides a further financing service to industry. Its method of financing complete installations as a unit, requiring two or more varying types and makes of equipment, has been approved and endorsed by many of the country's leading engineers.

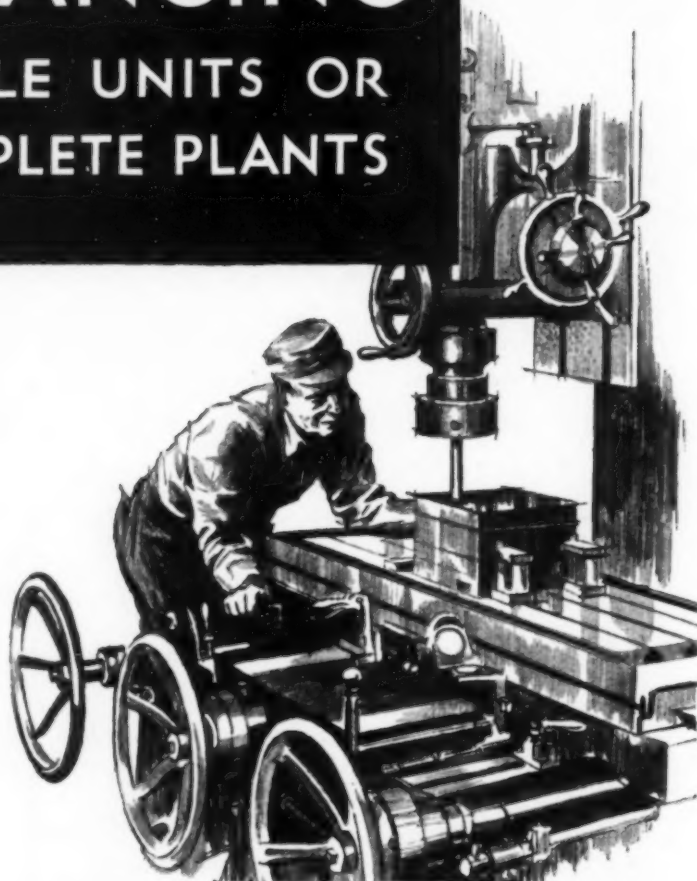
FINANCING SINGLE UNITS OR COMPLETE PLANTS

The machinery and equipment in your plant will be your profit barometer for the year to come—

It must be modern and up to date in every respect to meet the storms of competition—to combat the economic winds of adversity—to fight the treacherous currents of obsolescence.

Don't tie up your working capital or established credit lines to modernize. Use Commercial Credit service which is a supplementary credit allowing payment for modernization from its effected savings.

Write, today, for full information—know this service and its advantages.



COMMERCIAL CREDIT COMPANIES

COMMERCIAL BANKERS

CASH CAPITAL and SURPLUS \$58,000,000

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COMMERCIAL CREDIT COMPANY, Inc., New Orleans
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NATIONAL HEADQUARTERS, Baltimore

B-4

COMMERCIAL CREDIT COMPANIES, Baltimore, Maryland

Give us full information, without obligation, about Commercial Credit Plans.

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By

Address

Title

For Winter Waterproofing and Dampproofing Work

HEADLEY EMULSIFIED ASPHALTS

Applied cold,—not destroyed by freezing

WINTER preheating of solid asphalt, maintaining fluidity during transfer and application, avoiding the chilling that prevents secure and complete bond to damp or cold surfaces, tedious mopping to obtain uniform coating—all take skill and time, piling up labor and waste-material costs.

Cut-back asphalts eliminate the heating kettle, but the solvent robs the asphalt of its best protective and bonding qualities. Furthermore, they are a fire hazard and a menace to workmen's health.

Clay-suspended asphalts, unless loaded with anti-freeze compounds, are destroyed by freezing. The



bond is not as complete or secure to damp or cold surfaces and they are dependent on drying before setting.

Headley Emulsified Asphalts are applied cold to cold or damp surfaces. They spray or brush easily *at any time of the year* without diluting. They bond securely and set readily even in the winter months. No skilled labor or special tools are required. There is no waste. These characteristics make Headley Emulsified Asphalts safe, efficient and economical for use *at any time of the year*.



Literature and Specifications covering standard applications will be mailed on request, and our Research and Development Department will cooperate in connection with new or exceptional uses.



Headley Emulsified Products Company
Emulsified Asphalts for Industrial Uses
Largest Exclusive Manufacturers since 1908
Franklin Trust Building, Philadelphia
Branch Offices: New York and Chicago
Works: Marcus Hook, Pa.

HEADLEY EMULSIFIED PRODUCTS COMPANY,
Franklin Trust Building, Philadelphia
Branch Offices, New York and Chicago

☐ Please send Bulletin 330 and free sample of Headley Emulsified Asphalt.

Name and official position

Name of Company

Address

CM



T. L. Smith Tilting Mixers in one, two and four yard sizes and Insley Gantries are worthy companions on large concrete jobs.

INSLEY

Concrete Placing Equipment

Big Concrete Dams—Conowingo, Safe Harbor, Bagnell, Rock Island

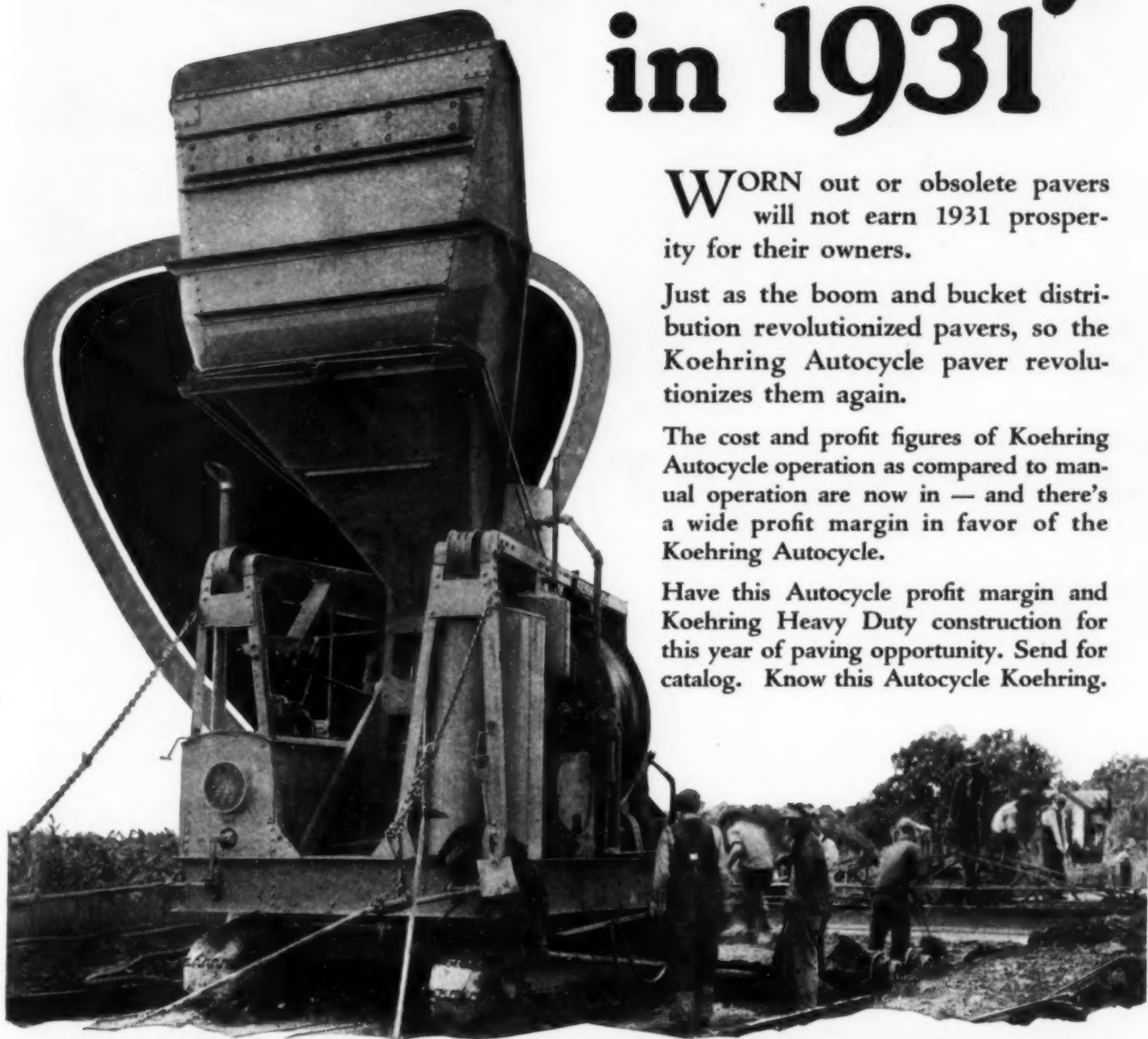
On all of these jobs concrete was placed by Insley Gantries—self propelled units carrying concrete towers and chutes as well as derricks for hoisting—especially designed by Insley engineers to handle the problem of placing concrete on each specific job . . . This is an example of Insley engineering service, and these big jobs are examples of the fact that wherever big and important concrete work is going forward, there Insley equipment will be found.

National Equipment Corporation



Milwaukee

— if you're going to make money in 1931



WORN out or obsolete pavers will not earn 1931 prosperity for their owners.

Just as the boom and bucket distribution revolutionized pavers, so the Koehring Autocycle paver revolutionizes them again.

The cost and profit figures of Koehring Autocycle operation as compared to manual operation are now in — and there's a wide profit margin in favor of the Koehring Autocycle.

Have this Autocycle profit margin and Koehring Heavy Duty construction for this year of paving opportunity. Send for catalog. Know this Autocycle Koehring.

KOEHRING

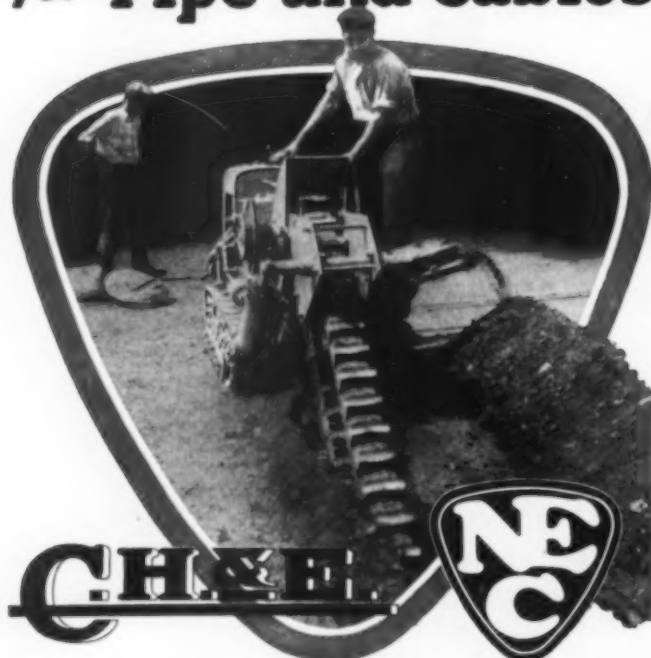
National Equipment Corporation



Milwaukee

A 6202-I

Digs 3"-6" Trench for Pipe and Cables



Goldigger

A new cost-saver and speed maker—for small ditch work—and there's a lot of it all the time.

That's why the C. H. & E. little Goldigger ditcher is a remarkable money-maker for contractors, municipalities, public utilities, etc.

So small, so adaptable, it does almost any job that hand labor will do—digs trenches for gas service connections, high pressure gas lines, small oil pipe lines, telephone cables, sprinkling and drain pipes on golf courses or airports, ornamental lighting cables!

Output capacity is equivalent to 15 men!

Digs trenches 3 in. to 6 in. wide, 48 in. deep.

Cuts down backfilling because it does not need the working room required for hand work—takes less dirt out, leaves less to go back!

Full multiplanes of low ground pressure take the little Goldigger over any soil, or over lawns without injury!

Only waist high—exceedingly compact—the little Goldigger needs little clearance for trees, buildings, etc.

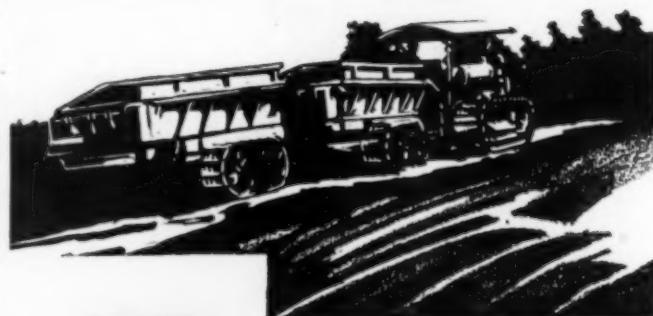
Small—yes—but a rugged, powerful, capable, money-making, labor-saving machine.

Write for special circular—The Goldigger Model "A" Ditcher!

**National Equipment
Corporation** *Milwaukee* 

A 6205-1/2

DIXON'S



**WATERPROOF
GRAPHITE
GREASE**

TRY IT ANYWHERE THE GOING'S HARD

THAT'S the quickest way to know that lubricating troubles around your construction operations are over once and for all.

Try it on exposed gears. See how it clings to the teeth.

Try it on wire ropes. Graphite penetrates the strands and lubricates them.

Try it on pump plungers. Water won't wash it off.

Try it on exposed equipment, where acid or alkali water is present. Graphite prevents rust.

Try it anywhere the going's hard—and you, too, will be satisfied.



Other DIXON Products

Graphite Gun Grease Solid Belt Dressing
Flake Graphite Pipe Joint Compound
Industrial Silica Graphite Paint

Joseph Dixon Crucible Co.

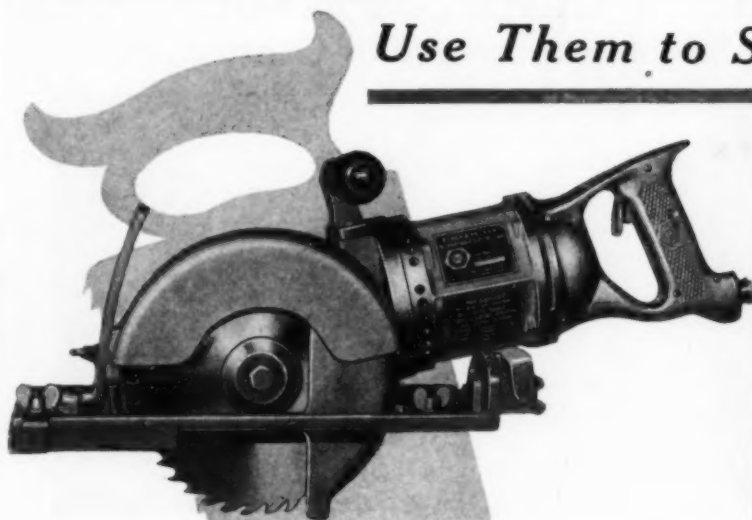
Jersey City



New Jersey

These **ELECTRIC TOOLS** **SPEED UP** Construction

Use Them to Save Time and Labor!



PORTABLE ELECTRIC SAWS DO THE WORK OF SIX MEN

HERE is a Portable Electric Saw that rips six times as fast and crosscuts seven times as fast as hand sawing. Ideal for all types of building work, large construction jobs, repair work, etc. Built in three sizes—6", 8" and 10"—ball bearings throughout, with chrome nickel shafts and gears.

Powerful Universal Motors use A. C. or D. C. Can be connected to any electric light socket. Table adjustable from 0° to 45° bevel cutting and other special sawing operations. By using the proper blade or abrasive disc these saws will also cut light metal, slate, marble, asbestos, tile, transite and porcelain.

Special safety features include an automatic telescopic guard which entirely encloses the blade and protects the operator. Complete with one rip blade, one cross-cut blade, adjustable saw fence, three-conductor cable with safety wire for grounding, and convenient carrying case with handle.

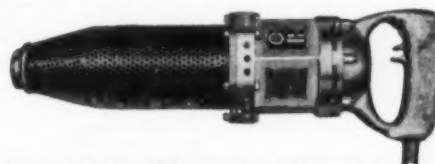
See Them at Your Distributors



1/2-Inch Portable Electric Drill

The Black & Decker 1/2-inch Drill is the most popular drill in the world. It is used more than any size of any other make. Weighs only 12 1/2 pounds. Very easy to handle, yet so powerful that a man cannot stall it, even when drilling up to its maximum capacity in steel.

Great power plus low spindle speed make this an ideal tool for all general construction drilling up to 1/2 inch. Universal motor operates on A. C. or D. C. Other Black & Decker Portable Electric Drills are available in sizes from 1/4-inch to 1 1/2-inch—for every drilling operation.



Portable Electric Hammers

Sturdily made and very powerful, yet light in weight and easily handled. Made in three sizes, suitable for drilling in brick and concrete, light steel chipping and driving wood-working chisels—wherever hammering action is needed. Remarkably fast and useful in many ways on construction jobs. Blows are struck at rate of several thousand per minute.

Fitted with Universal Motors operating on A. C. or D. C.



Electric Screw Drivers

Powerful, ball-bearing, electric tools for driving screws and nuts. Similar in construction to Black & Decker Electric Drills, except that spindle is provided with a Positive Clutch which releases screw when forward pressure on tool is relieved.

Ideal for driving any wood screw up to No. 16-inch by 3 1/4-inch long in hard wood, log screws up to 3 1/6-inch by 4-inch long, and nuts on bolts up to 3/8-inch diameter. Built for convenience in handling. Driven by Universal Motors.

Your Jobber Has Them!



TOWSON, MARYLAND, U. S. A.

Slough, Bucks.,
England

Toronto, Ontario,
Canada

Sydney,
Australia

Mail This Coupon for Catalogue

CON

The BLACK & DECKER MFG. CO.
Towson, Maryland, U. S. A.

Please send me your catalog showing the full line of Black & Decker Portable Electric Tools. I am particularly interested in:

Electric Saws Electric Drills
Electric Screwdrivers Electric Hammers

Name.....

Address.....

Distributor's Name.....

Be Prepared for That Wet Job!

Don't let the water hazard jeopardize your profit on that excavation, sewer, pipe line, or bridge job

GET "Domestic" Pumps AND BE SAFE
 Sizes and types for all conditions encountered by Contractors



For Volume Pumping use "Domestic" Self-Priming Centrifugal Pumps

2 1/2 in., 3 in., 4 in., 5 in., 6 in. and 8 in. suction and discharge sizes. Capacities—200 to 2,000 gallons per minute.



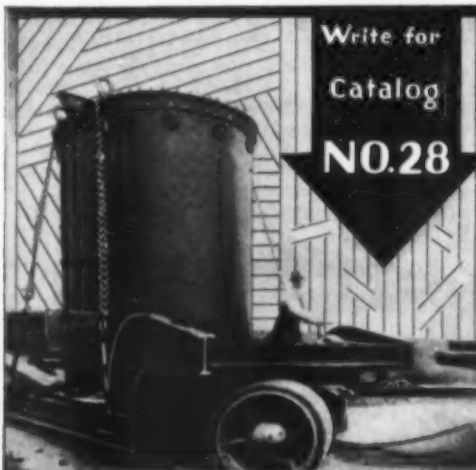
For Seepage or Clean-Up Pumping duties use "Domestic" Single- and Double-Diaphragm Pumps

Furnished in 3 in. single and 4 in. single and double Pump Units.

Write us today for descriptive bulletins

DOMESTIC ENGINE & PUMP CO.—Manufacturers—Shippensburg, Penna.

Distributors in all principal cities throughout the United States.



Write for
 Catalog
NO. 28

ROGERS

World's  Standard

HEAVY **DUTY**

TRAILERS

ROGERS Trailers, built by the pioneer designers of low bed or "carry-all" trailers, occupy a dominating position and have been identified with a majority of the outstanding moving jobs.

Types are available, conforming to the requirements of every community. Sizes range from 5 tons with 4 wheels to 100 tons with 12 wheels.

Write for Catalog No. 28 stating your problem. Sound, practical advice will be furnished without obligation.

ROGERS BROTHERS CORPORATION
 106 Orchard St., Albion, Penna.

...the Glove that Converted an Army

Sabin Co., Gloves
 536-40 W. Federal St., Youngstown, Ohio

Enclosed find \$1.60 for sample pair your No. 259 glove size

Please quote us price on Don. pair

No. 259 glove sizes

Name

Address

Individually, by gangs and by crews, an army of men in the construction field have "gone over" to Sabin Gloves.

After trying they know that Sabin Gloves do give them more for their money. They have found you can't tie them for comfort—that water or rough work doesn't hurt them—and that they last longer.

Get converted to Sabins—a trial of No. 259 will do it. Just use the coupon. Here's a real glove with six inch cuff, outseams and holdtight back with buffed Carpincho leather hand and back.

SABIN CO.,—Gloves

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No. 259

Where

Taxpayer—Road Official—Contractor is *best* served!



NEVER have better roads been built than today! Never has cost per mile been pegged so low! Never has road building and maintaining equipment been so efficient!

Today, the road builders of the nation are standing on the threshold of an era of greater activity than any the past has seen! The great sums of public money to be expended improving roads this year will put finer transportation

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The art of road-building was never at a higher point. Engineering achievement, sound initiative and the progressive design of road building and maintaining equipment is responsible for this condition.

Wherever you find Austin-Western Road Machinery at work—there you will find the interests of taxpayer—road official—contractor best served!

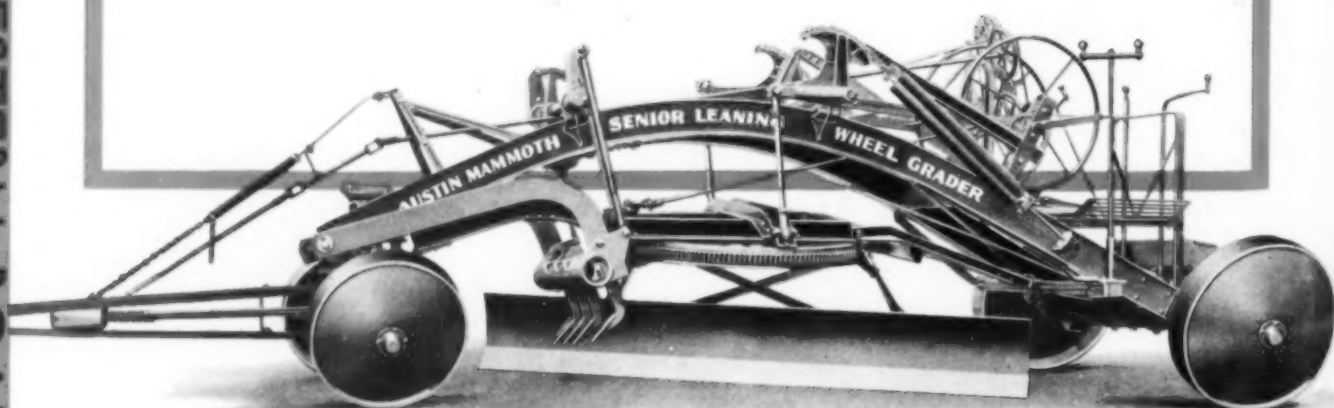
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ROAD MACHINERY

AUSTIN-WESTERN ROAD MACHINERY COAST TO COAST



Unsurpassed for sheer "workability"



**Austin Mammoth Senior Leaning Wheel Graders
with Rip Snorter Scarifiers set new records
for efficient, low cost, labor-saving operation . . .**

WEIGHT—rugged strength—ability to do the "dirtiest" and toughest jobs—such are the qualities that set these famous combination graders and scarifiers apart from all others of their kind.

Doing work in a single operation that formerly required several laborious and costly operations is typical of the advantages that all Austin-Western Road Machinery holds for road builders. The model illustrated has a twelve-foot blade—disc wheels with remov-

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Now is the time to find out just what this amazingly complete line has to offer for 1931. Send for full descriptions and specifications for your files—today!

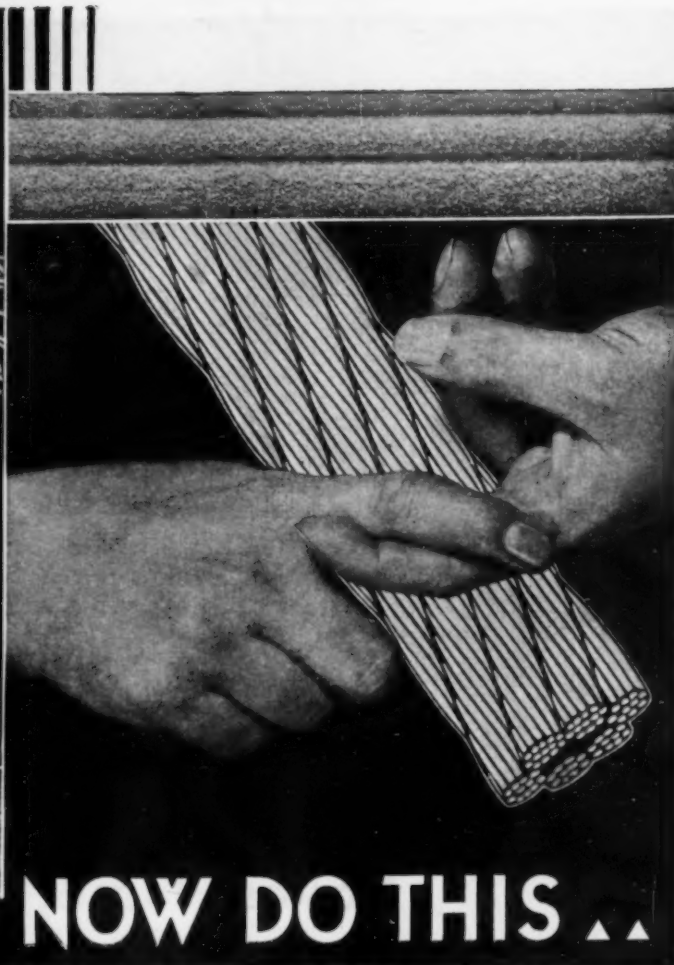


THE AUSTIN-WESTERN ROAD MACHINERY CO.
400 North Michigan Avenue * CHICAGO, ILLINOIS * Branches in principal cities

Leaning Wheel Graders, Straight Wheel Graders, Motor Graders, Elevating Graders, Crawler Dump Wagons, Scarifiers, Rock Crushers, Portable Conveyors, Rollers, Motor Sweepers, Sprinklers, Road Oilers, Hot Patch Portable Asphalt Plants, Plows and Scrapers.



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LIKE THIS**

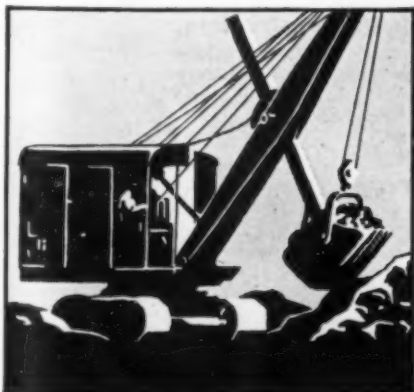


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80 DAYS ON A LORAIN 75A

.. and no broken wires yet

An Indiana Stone Company reports 30 days maximum service with ordinary wire rope. Compare this with Tru-Lay Preformed Wire Rope—80 days—an increase of 166%. And at the time this report was received Tru-Lay was still doing service... going strong... and not a wire broken!



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Cross your fingers and note the pressure—move your fingers and note the rubbing action. In Tru-Lay Preformed Wire Rope this internal stress and excessive rubbing action is eliminated. Strands and wires are shaped to fit perfectly together. They lie normally in position as when you hold your two hands together as shown above.

Internal stress in ordinary wire rope is the reason for seizing the ends. Even when seized close to the end, the strands and wires brush out. Tru-Lay, when cut, does not require seizing. Strands and wires lie in place. This is evidence that preforming eliminates internal stress.

Let us show you that what Tru-Lay does for others Tru-Lay will do for you... namely, 30% to 300% increased service in wire rope, depending on the nature of the service and character of equipment.

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PREFORMED WIRE ROPE
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CALCIUM CHLORIDE CURING

**Saves Time,
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The modern Calcium Chloride method greatly simplifies the curing process and saves considerable labor and material expense.

Spread Calcium Chloride immediately after removal of the wet burlap and the whole job is done. Curing is uniform. High early strength is attained. High permanent strength is assured.

The spreading of Calcium Chloride takes but a few hours of one man's time as contrasted with the greater labor involved in the dirt or straw and sprinkling method.

Calcium Chloride curing has been approved by the Bureau of Public Roads after thorough tests. Interesting booklets describing this efficient method are issued by the member companies. Send the coupon.

Calcium Chloride Publicity Committee

Send this coupon to any one of these companies

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Without obligation please send booklets on Calcium Chloride concrete curing practice.

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CM 2-31



A Sensational Performer and Money Saver

THE speed, versatility, rugged construction, big yardage and low cost of the Funder combination shovel, ditcher and crane, make it a sensational performer and money saver.

It makes small jobs profitable. Fast, full $\frac{3}{4}$ circle swing, $\frac{1}{3}$ yard dipper capacity, $16\frac{1}{2}$ foot radius, gasoline power.

With Trench Hoe attachment for ditching or Boom Extension for clamshell, dragline or crane, the Funder is an unbeatable three-in-one digging machine.

Get the details and name of nearest dealer. Address—

The Funder Hoist & Shovel Co.
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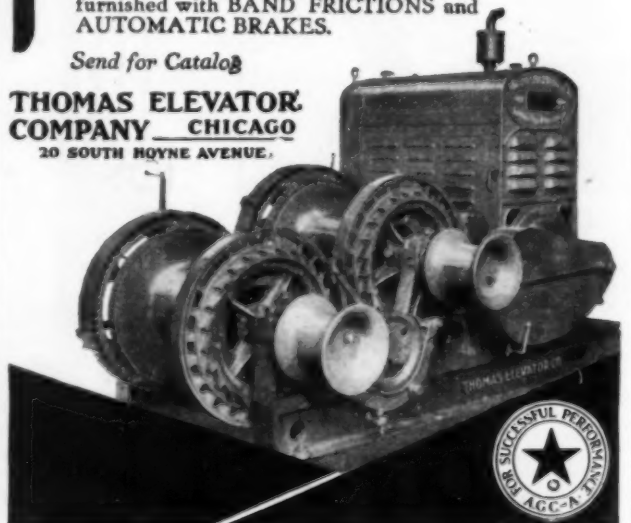
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are preminent in Construction.

Built in all sizes to do all hoisting jobs faster and more dependably. Regularly furnished with **BAND FRICTIONS** and **AUTOMATIC BRAKES**.

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The Easiest Operating Graders Ever Built

Ask any operator who has had the opportunity to compare Leaning Wheel Graders. He will tell you that the GALION with its Leaning Wheel Principle; its Automatic Skew Axle, and its famous E-Z Lift Gearing, is positively the easiest operating Grader ever made.

But easy operation is only one of its outstanding qualities. Economy and Performance are two other reasons why GALION Graders win ready acceptance wherever Graders are put to a test.

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There are nine sizes to choose from, with a moldboard range of from 7' to 14', weighing from 3,200 lbs. to 11,000 lbs.

Write for descriptive catalog giving you complete information on each size.

THE GALION IRON WORKS & MFG. CO.
GALION, OHIO

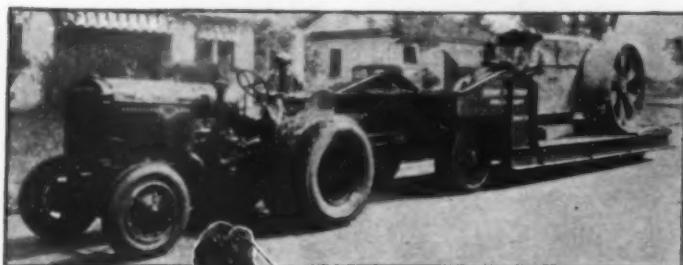
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MAKE your own comparisons! See how *extra strength* has been built into the modern WILLIAMS "Arch-Girder" Trailer, without added weight.

You can haul bigger loads, at lower costs, because of WILLIAMS' sturdier construction:

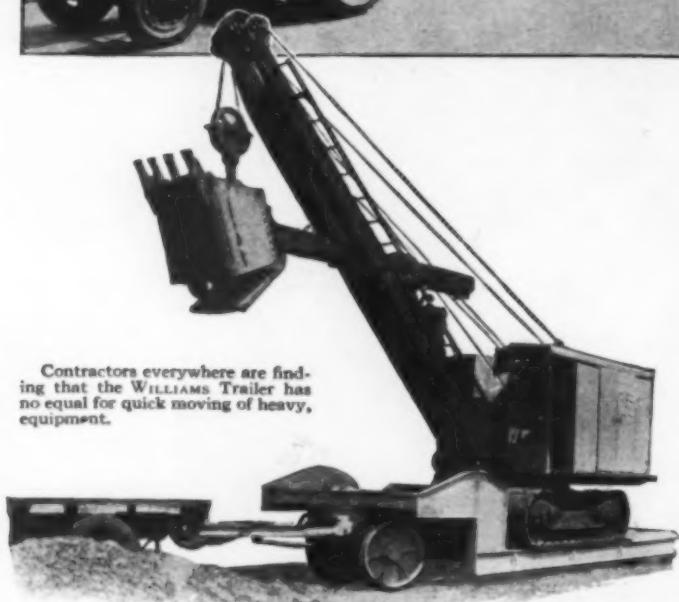
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EASIER RUNNING. Your truck uses less gas to pull a WILLIAMS Trailer, because every wheel turns on big over-size Timken Bearings.

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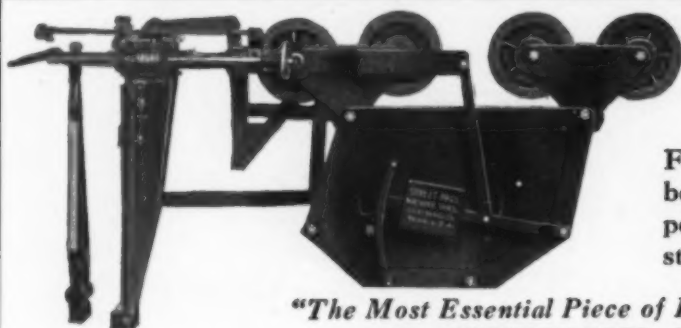
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Fall rope carriers set off mechanically. Roller bearing thruout. Designed for high speed with positive control. Powered by a double drum steam, electric or gasoline street hoist.

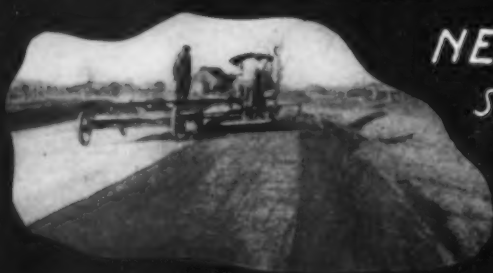
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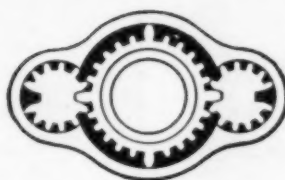


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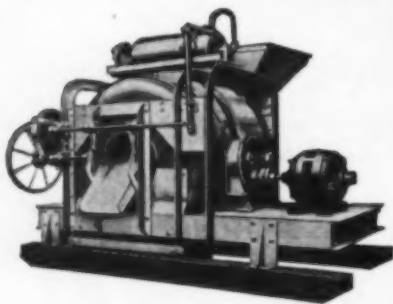
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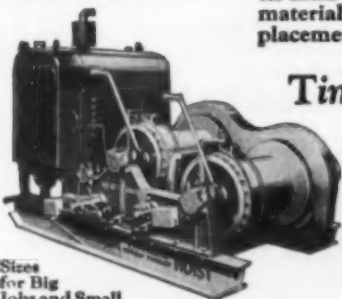
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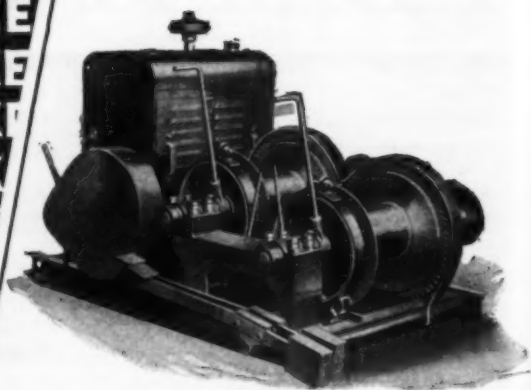
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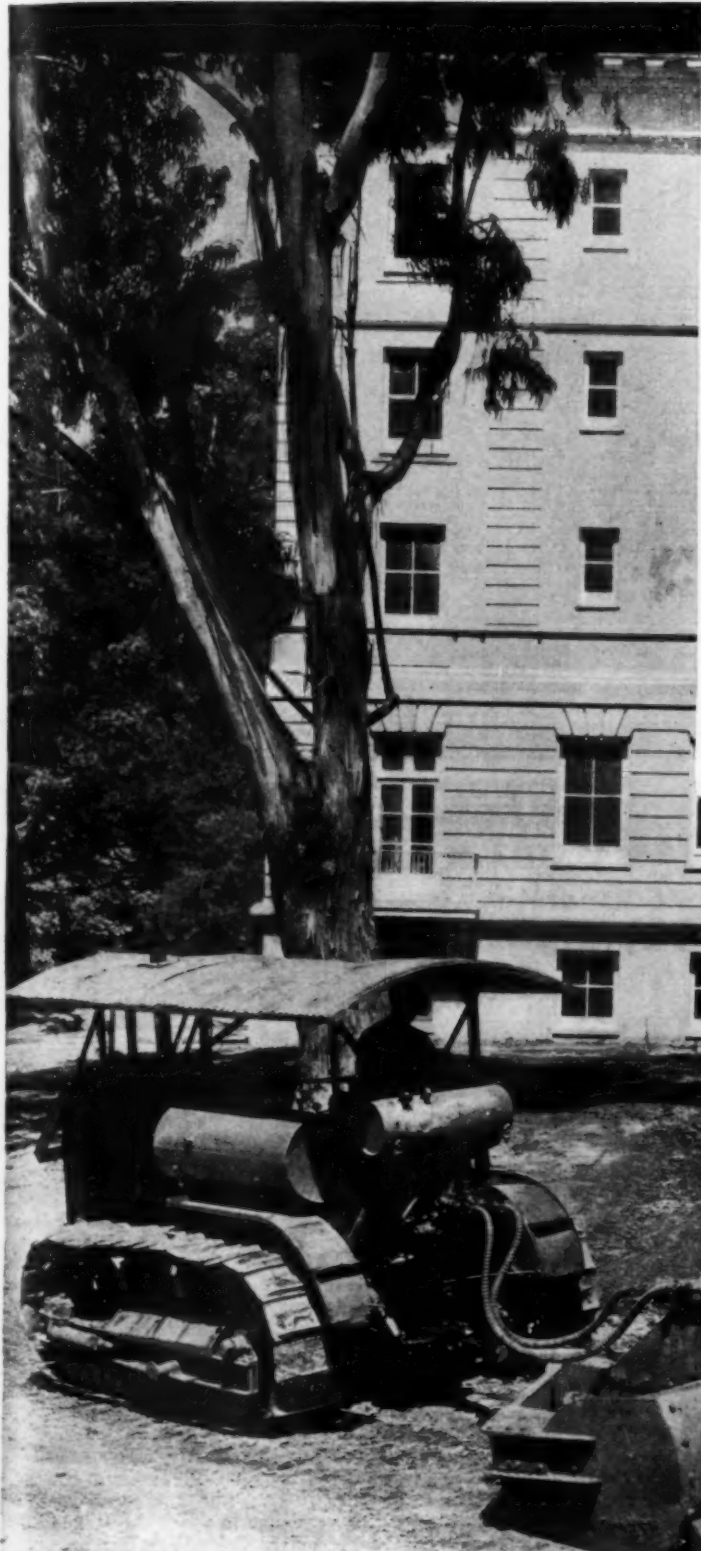
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Low in Operating Costs. Proof of this statement can be found on the books of every contractor using DAKE HOISTS today. The reasons are many—the large substantial bearings—the arc-welded steel construction—the steel drums—the ease of control—the powerful brakes—and the unusual lightness of weight—all of these mean low operating costs.

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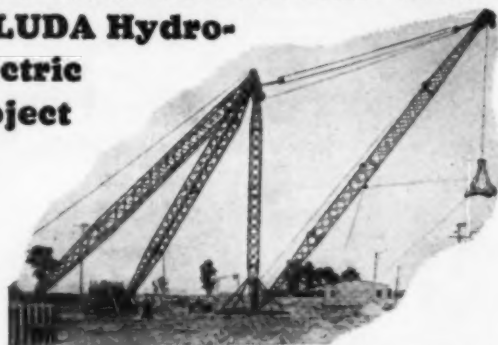
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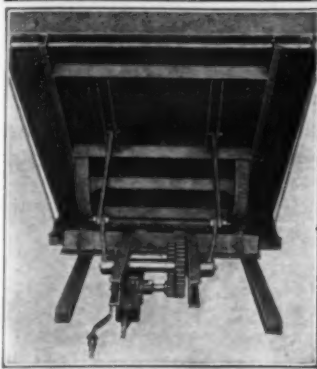
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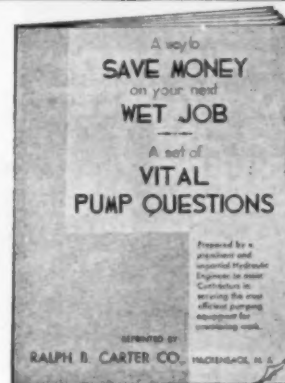
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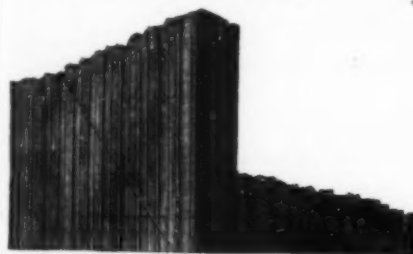
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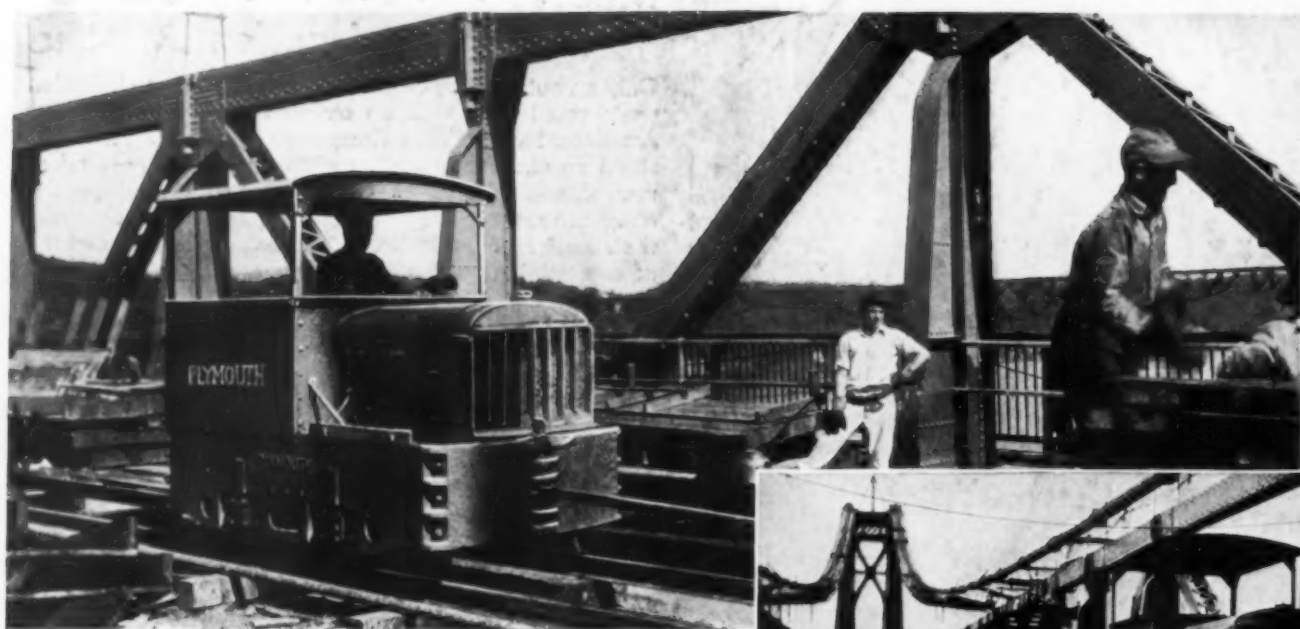
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Mr. L. G. Litchfield, of Scott Brothers Construction Company closes his letter to us by saying: "We were very well satisfied with the performance of our Plymouths on this job."

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